

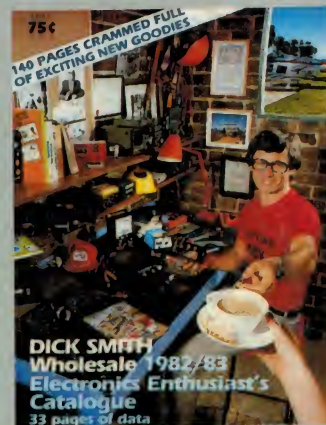
APR 1982

eti

ELECTRONICS TODAY INTERNATIONAL

\$1.95 NZ \$2.50

DICK SMITH CATALOGUE



Check Inside

ROBOT TO BUILD



SPECIAL OFFER

**Tasman Turtle
Robot Kit**

**Programming
the '660
in Colour**

**Sansui TU-S33
Tuner Reviewed**

**'CIRCUIT FILE'
New Feature**

Percussion Synthesiser Project

Toolkit and Tools to Win in 'Minitools' Contest!



Let Your Imagination Run Wild

Imagine the dynamic sound of a quality stereo system. And imagine how nice it would be if you could take this sound along with you wherever you go. A fairy tale? Not at Sansui. We let our imagination run wild and developed Portable Component Systems, the newest Sansui Hi-Tech Compo sound idea.

The creative folks at Sansui borrowed many advanced features from full-size home components. Next, we packed them all into tiny

mini-component-sized packages. And as a final touch, we snapped them together and attached a convenient carrying handle.

The result? Dynamic sounding portables that disassemble to form full-feature mini component systems.

Sansui. Imagine what we'll do next.

**Hi-Tech
Compo**
Compact, high-technology
components for modern lifestyles



PORTABLE COMPONENT SYSTEM CP-7

SANSUI ELECTRIC CO., LTD. 14-1 Izumi 2-chome, Suginami-ku, Tokyo 168 Japan
VANFI (AUST.) PTY. LTD. 297 City Road, South Melbourne, Victoria 3205, Australia Tel: 690-6200
283 Alfred Street, North Sydney, N.S.W. 2060, Australia Tel: 929-0293

Sansui



So you found a 10 kg gold nugget with our ETI 1500 metal detector and you'd like to share it with us?

... and a Big April Fool to you, too.

Roger Harrison
Editor

QUICK INDEX

FEATURES

- 8 Aust.-N.Z. on 1296 MHz!
- 13 Toolkit & Tools to Win — Contest!
- 18 Circuit File — New Feature
- 37 Tasman Turtle Robot Kit Offer
- 53 'Idea of the Month' Contest
- 106 1981 Index & Errata
- 146 Dregs

PROJECTS & TECHNICAL

- 29 645: Tasman Turtle Robot
- 41 469: Percussion Synthesiser
- 76 Disks, CP/M and your Computer
- 18 Circuit File: Power Supplies
- 50 Ideas For Experimenters
- 56 Shoparound
- 126 PC Board Artwork

COMPUTING TODAY

- 63 Powerful HP Interface Loop
- 67 Printout — News & Views
- 76 Disks, CP/M and your computer
- 82 How to Score — '660 Programming
- 88 Programming the '660 In Colour
- 97 Reverse Polish Notation
- 100 '660 Software — One-Handed Pong

SIGHT & SOUND

- 109 Satellite-to-Home TV: Close?
- 110 Sight & Sound News
- 114 Modern Tape Recorder Technology
- 130 Technics RS-M230 Cassette Deck
- 138 Sansui TU-S33 Tuner Review

GENERAL

- 8 News Digest
- 60 Babani Books — Mail Order
- 128 Mini Mart — Readers' Adverts
- 145 ETI Credits & Services

advertisers

Adaptive Electronics	14-15
Australian Government	7,102-103
Applied Technology	80-81
Altronics	46-47
Arena	113
Aust. Home Journal	125
Acoustic Foundry	94
All Electronic Components	40
AED	69
Auditec	135
A & R Soanar	10,117
AWA	56
Bishop Graphics	39
Bright Star Crystals	64
Bose	123
Castle Electronics	55
Consolidated Marketing	95
Cletronics	12
Computailor	84
Computer Country	65,144
Computerware	93
Cooper Tools	10
Computer City	64
Convoy	135,137
Dick Smith	12,26-27,74-75
Danish Hi-Fi	112
Delta	28
ETI Circuit Techniques	94
Electronic Agencies	12
Elmeasco	52
Emona	25
Energy Control	93
Electrocraft	79
Emac	55
Electronic Developments	55
Gellatly	71
GFS	79
Hagemeyer	148
Hy-tech	56
Hanimex	143
IFTA	120-121
Flexible Systems	48
Imark	28
Jaycar	22-23,51,57
John F. Rose	90-91
Leisure Press	140-141
Looky Video	12
Mail Order Centre	28
Microtrix	86
Mini-Tools	104-105
Magnetic Media	71
Micro80	62
Marantz	119
Maurice Chapman	136
Namal	64
National Pasonic	132-133
North Point Hi-Fi	136
Philips	124
Peterson	16
Pre-Pak	58
Powerchip	93
Q.T. Computers	66
Raimar	111,117
Rod Irving	38,49,54,68,72
Radio Despatch	79
Radio Parts	48
Sansui	IFC
Scientific Devices	108
S.I. Microcomputers	69
Sanyo	118
Software Source	73
Sheridan	17
SME Electronics	71
Sony	147
Stolmack	129
Top Projects	112
Truscotts	48
Tandy	101
Warburton Franki	87
United Sound Systems	36

eti

ELECTRONICS TODAY INTERNATIONAL



Robotics becomes all the rage! This issue features construction details for the 'Tasman Turtle' robot shown on the cover plus a special offer on kits for this project on page 37. ('Tasman Turtle' is a registered trademark of Flexible Systems).

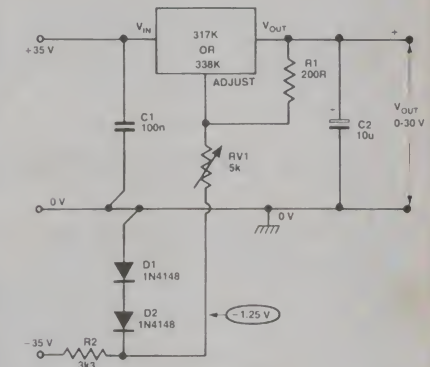
Cover design by Ali White and Githa Pilbrow.

*Recommended retail price only

features

TOOLS AND TOOLKIT TO WIN 13

First prize in this competition is a Minitool workshop kit, which includes a pistol drill, drill stand, flexible shaft unit, orbital sander, and much more. All you have to do to win is answer a few questions and write a short essay.



CIRCUIT FILE 18

In this first edition of our new series, design consultant Ray Marston takes a look at practical power supply and voltage regulator circuits.

projects



645: TURTLE ROBOT 29

Robotics is a fascinating subject for both electronics enthusiasts and the layman, and this could be the first opportunity ever to build a robot for your own home.

TURTLE ROBOT KIT 37

In this special offer to ETI readers you can get the complete 'Minimum Turtle' kit for only \$349. Usual price is around \$600!

news

NEWS DIGEST 8

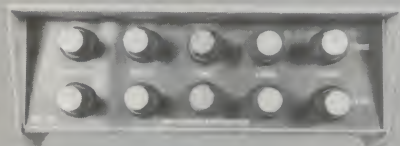
World record on 1296 MHz; Intruder alarm systems standard; Space age plastic for coax seals; Tough times for tantalums; etc.

PRINTOUT 67

GBUG — powerful monitor for 2650; Low power Z80; CHIP-8 intelligence; etc.

SIGHT & SOUND NEWS 109

Low-cost satellite to home TV receiver; Solid-state compact video camera from Sharp; and more.



469: PERCUSSION SYNTHESISER 41

With this instrument you can simulate drums, cymbals, snares and bongos as well as make an assortment of wonderful noises.

computing

COMPUTING TODAY 63

New interface from Hewlett-Packard increases HP-41 power and versatility; The 'little big board'.

DISKS, CP/M AND YOUR COMPUTER 76

Disks aren't just super-fast cassettes — they change the whole personality of your computer. It's also important to know a bit about a disk operating system, like CP/M, before you buy.

'660 SOFTWARE — HOW TO SCORE 82



PROGRAMMING THE '660 IN COLOUR 88

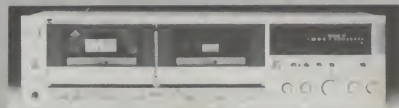
This article tells constructors of the ETI-660 how to put colour onto their TV screens.

RPN — THE NUMBER-CRUNCHING DEMON! 97

RPN stands for 'Reverse Polish Notation', which is a system providing a logical method for processing masses of numerical information.

'660 SOFTWARE — PONG! 100

sight & sound



MODERN TAPE RECORDER TECHNOLOGY 114

This article covers the technology and techniques employed in modern analogue tape and cassette recorders, illustrated with partial circuits and mechanical diagrams.

TECHNICS RS-M230 TAPE DECK 130

If you want good performance but don't wish to be bothered with all those fiddly adjustments for tape type, bias, etc., that the dedicated audio buff just loves, then the RS-M230 fully automated cassette deck could be just the thing for you. It offers excellent performance as well!

SANSUI TU-S33 TUNER 138

The TU-S33 tuner has been developed by Sansui to match exactly the characteristics and appearance of the AU-D22 and AU-D33 amplifiers, and for anyone living in a city radio situation, Louis Challis reckons you could do worse than this tuner for your radio reception.

general

IDEAS FOR EXPERIMENTERS 50

Idea of the Month contest and winner; Auto-reverse for split-phase motors; Square wave and pulse generator.

SHOPAROUND 56

LETTERS 59

ELECTRONICS BOOKS FROM ETI 60

Beginners' books, data books, circuit books, etc.

ETI 1981 INDEX & ERRATA 106

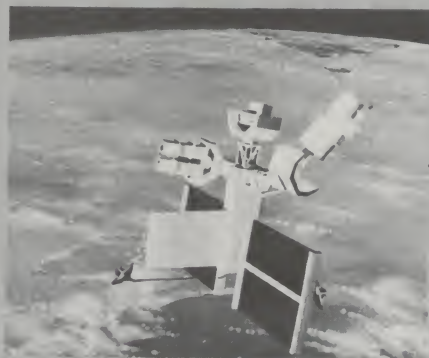
PC BOARDS 126

MINI-MART 128

ETI SERVICES 145

DREGS 146

next month



STARLAB

The Starlab Australian-Canadian UV Telescope Project is likely to be one of the most exciting things to happen to Australian Science until well into the next century. It promises to revolutionise our knowledge of the universe, while assuring Australian astronomers a place in the front rank of world astronomy.

ETI-670 ASCII KEYBOARD

Sorry, folks, but production problems have forced us to delay this project a month. Don't miss the May issue if you're waiting on this one.

PUBLIC ADDRESS AMP.

Built around the ETI-499 150 W MOSFET module, this public address system will drive 4 ohm loads or standard 70 V/100 V lines for horn speaker systems. Provision for several mic inputs and a line input has been included and you can add on our ETI-486 Howl-Round Stabiliser for feedback control.

TURTLE ROBOT — MORE

The Tasman Turtle Robot project continues with mechanical construction, plus electronics and controller. Get into robotics, it's the coming thing!

B&W DM12 SPEAKERS

Bowers & Wilkins set out to develop a 'mini monitor' system with some of the attributes of their illustrious Model 801s — and seem to have come quite close to the mark. See what Louis Challis has to say.

Although these articles are in an advanced state of preparation, circumstances may affect the final content. However, we will make every attempt to include all features mentioned here.

OUR CUSTOMERS TELL US...

the way you sent my last order was the best I have ever seen.

I wrote the order & sent it on our mail plane on a Friday, it had to go to Mt Isa Post office then to you, well the next Friday I received my order on the plane. No one can do better than that.

I thank you W. J. Brown

...WE HAVE THE BEST MAIL ORDER SERVICE IN AUSTRALIA

Don't forget our super fast road or air freight service anywhere in Australia for just \$7.00. This service is normally overnight. However, for delivery to remote country properties, allow 48 hours. Dick Smith Mail Orders — for fast service and fast delivery.

Dear Customer,

Quite often, the products we advertise are so popular they run out within a few days. Or, unforeseen circumstances might hold up goods so that advertised lines are not in the store by the time the advert appears. Please don't blame the store manager or staff; they cannot solve a dock strike on the other side of the world, or even locate a shipment that has gone astray. What we are trying to say is that, if you are about to drive across town to pick up a particular line at a Dick Smith store, why not give the store a ring first (addresses/phone numbers below) ... just in case! Thanks.

Dick Smith and Staff.



DICK SMITH Electronics



NSW 145 Parramatta Road AUBURN 658 0558 • T55 Terrace Level BANKSTOWN SQUARE 707 4888 • 613 Princes Hwy BLAKEHURST 546 7744 • 552 Oxford St BONDI JUNCTION 387 1444 • 808 George St BROADWAY 211 3777 • 531 Pittwater Rd BROOKVALE 93 0441 • 147 Hume Hwy GORE HILL 439 5311 • 396 Lane Cove Rd NORTH RYDE 888 3200 • 30 Grose St PARRAMATTA 683 1133 • 125 York St SYDNEY 290 3377 • 173 Maitland Rd TIGHE'S HILL 61 1896 • 263 Keira St WOLLONGONG 28 3800 VIC 399 Lonsdale St MELBOURNE 67 9834 • 260 Sydney Rd COBURG 383 4455 • 656 Bridge Rd RICHMOND 428 1614 • Dandenong Rd SPRINGVALE 547 0522 • 205 Princes Hwy GEELONG 78 6363 • Ross Smith Ave and Nepean Hwy FRANKSTON 7839144 ACT 196 Gladstone St Fyshwick 80 4944 QLD 166 Logan Rd BURANDA 391 6233 • 842 Gympie Rd CHERMSIDE 59 6255 SA 60 Wright St ADELAIDE 212 1962 • 435 Main North Rd ENFIELD 260 6088 • Cnr Main South Rd & Flagstaff Rd DARLINGTON 298 9877 WA Cnr Wharf St & Albany Hwy CANNINGTON 451 8666 • 414 William St PERTH 328 6944 Mail Order Centre: PO Box 321, North Ryde 2113. Phone (02) 888 3200

SHOPS OPEN 9am to 5.30pm
(Saturday: 9am till 12 noon)
BRISBANE: Half hour earlier.
ANY TERMS OFFERED ARE TO
APPROVED APPLICANTS ONLY

POST & PACKING CHARGES

ORDER VALUE	CHARGES
\$5.00-\$9.99	\$1.20
\$10.00-\$24.99	\$2.20
\$25.00-\$49.99	\$3.30
\$50.00-\$99.99	\$4.40
\$100.00 or more	\$6.00

Charges for goods sent by post in Australia only
— not airmail, overseas or road freight.

MAJOR DICK SMITH RE-SELLERS

ATHERTON, QLD: Joo Sue's Radio Service
55 Main Street, Phone: 91 1208

BENDIGO, VIC: Sumner Electronics
7 Edward St. Bendigo Ph: 43 1977

BALLINA, NSW: A. Cummings & Co.
91-93 River Street, Phone: 86 2285

BROKEN HILL, NSW: Crystal TV Rentals
66 Crystal Street, Phone: 6897

CAIRNS, QLD: Thompson Instrument Services
79-81 McLeod Street, Phone: 51 2404

COFFS HARBOUR, NSW: Coffs Hbr Electronics
3 Coffs Plaza, Park Ave. Phone: 52 5684

DARWIN, NT: Kent Electronics
42 Stuart Hwy, Phone: 81 4749

DARWIN, NT: Ventronics
24-26 Cavanagh Street

EAST MAITLAND, NSW: East Maitland Elect.
Cnr Laws & High Streets, Phone: 33 7327

GERALDTON, WA: KB Electronics & Marine
361 Main Terrace, Phone: 21 2176

GOSFORD, NSW: Tomorrow's Electronics
68 William Street, Phone: 24 7246

HOBART, TAS: Beta Electronics
123a Bathurst Street, Phone: 34 8232

KINGSTON, TAS: Kingston Electronics
Channel Court, Phone: 29 6802

LAUNCESTON, TAS: Advanced Electronics
5a The Quadrant, Phone: 31 7075

LISMORE, NSW: Decro Electric
Magellan St. & Brunner Hwy, Phone: 21 4137

MACKAY, QLD: Stevens Electronics
42 Victoria Street, Phone: 51 1723

MARYBOROUGH, QLD: Keller Electronics
218 Adelaide Street, Phone: 21 4559

MT GAMBIER, SA: Hutchesson's Comm.
5 Elizabeth Street, Phone: 25 6404

MILDURA, NSW: McWilliams Electronics
40 Lemon Avenue, Phone: 23 6410

NAMBOUR, QLD: Nambour Electronic Shop
Shop 4 Lowan House Ann Street, Phone: 41 1804

NEWCASTLE, NSW: Elektron 2000
Shop 18, Hunter Shopping Village, Phone: 26 2644

ORANGE, NSW: M & W Electronics
173 Summer Street, Phone: 62 6491

PENRITH, NSW: Acorn Electronics
Shop 12 541 High St, Phone: 36 1466

PORT MACQUARIE, NSW: Hall of Electronics
113 Horton Street, Phone: 83 5486

ROCKHAMPTON, QLD: Purely Electronics
15 East Street, Phone: 21 058

SOUTHPORT, QLD: Amateur's Paradise
Shop 144 Scarborough St, Phone: 32 2644

TAMWORTH, NSW: Sound Components
111 Bridge Street, Phone: 32 9677

TOOWOOMBA, QLD: Hunts Electronics
18 Neil Street, Phone: 32 9677

TOWNSVILLE, QLD: Tropical TV
49 Fulham Road, Vincent Village, Phone: 79 1421

TRARALGON, VIC: Power'n'Sound
147 Argyle Street, Phone: 74 3638

WAGGA, NSW: Wagga Wholesale Electronics
82 Forsyth Street

WODONGA, VIC: A & M Electronics
78a High Street, Phone: 24 4588

WHYALLA, SA: Mallor Enterprises
Shop 2, Forsyth Street, Phone: 45 4764

These are our major dealers, however we cannot guarantee they will have all these items in stock and at the prices advertised.

Join the people who have made the Air Force their life



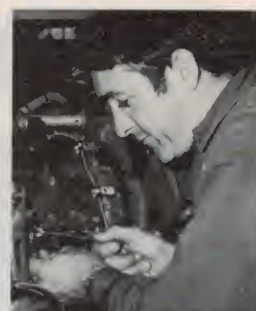
"I've seen a lot of Australia. Now I'm looking forward to being posted overseas."



"I enjoy being a member of the team that keeps our F111's fully operational."



"You're trained to work on some of the most advanced equipment in the world."



"The opportunities for promotion with more pay and responsibility are there."



"You don't mind working hard if it's for a specific purpose like the country's security."



"At 23 I found myself promoted to Section Head. That kept me on my toes."



"It isn't all work I have time to relax and play my favourite sport."



"The training has set me up with a career for life — it's really professional."

The satisfaction and rewards are immense.

A new lifestyle. New friends. New interests. New qualifications. New places visited.

And you start on full adult pay too! After training we'll pay you even more! Then there's four weeks annual leave and the opportunity to continue studying for higher qualifications. So if you want to reach a higher rank, it's up to you.

It's not an easy life.

Success demands application. A disciplined approach to your work. What's more, you'll be part of a special team that's proud to wear the Air Force uniform.

Normally you'll work a five day week. But at times we expect you to do extra duties.

You must be prepared to join us for a minimum of six years and be prepared to live and work on any one of our bases.

Your future.

Is it in Flight Systems, Propulsion Systems, Air Frames, Telecommunications, Engineering, Administration, Weaponry, Supply or Motor Transport?

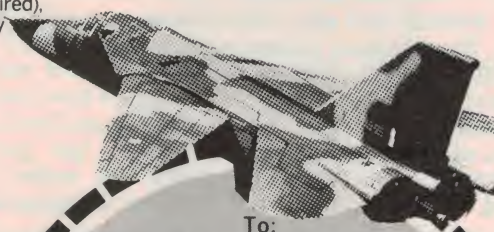
The choice is vast. The scope unrivalled.

So if you're aged between 17 and 34 years (17 and 43 years if no trade training is required), an Australian citizen or meet our nationality requirements, we would like to meet you. (People with civilian qualifications and experience are most welcome to apply.) Enquiries are also invited for Apprenticeships.

Today, walk into the Air Force Recruiting Office nearest you and have a chat with a Careers Adviser. The address is in the phone book. It could be your first important step to an exciting new career.

Alternatively send the coupon or phone for the facts:

Brisbane:	Townsville:	Sydney:
226 2626	71 3191	212 1011
Wollongong:	Parramatta:	Canberra:
28 6294	635 1511	82 2333
Hobart:	Adelaide:	Perth:
34 7077	212 1455	325 6222
Melbourne:	Newcastle:	
61 3731	2 5476	



To:
RAAF CAREERS
ADVISER. G.P.O. Box XYZ
in the capital city nearest you
Yes! I am interested in an RAAF
career. Please send me full details.

Name

Mr/Miss

Address

State

Postcode

Date of Birth:

RG.417.FP.11ET

You're somebody in Today's Air Force

Authorised by Director-General Recruiting Dept. Defence

Australia to New Zealand on 1296 MHz!



Dick VK2BDN and his well set-up station.

— world record claimed

On the morning of 9 February last, a Sydney radio amateur, Dick Norman VK2BDN, contacted a New Zealand amateur, Brian ZL1AVZ, on 1296 MHz — gaining not only a first for spanning the Tasman on that band, but possibly a world record to boot!

The current world distance record for this band stands at 2107 km, held by VK5MC and VK6KZ (set on 29.12.78). The distance between VK2BDN and ZL1AVZ is calculated to be 2134 km. If confirmed, the two operators will hold the new world distance record for this band.

The action started on 25 January at 1920 Eastern Australian Summer Time when Dick Norman received a phone call from New Zealand stating that the two metre band (144-148 MHz) was open between eastern Australia and New Zealand. Dick promptly got going on 432 MHz and worked ZL2VT, the contact lasting for over an hour.

He also worked ZL2TAL, ZL2THG and ZL1TBG. Signals were peaking to S8. This band was still open at 2200 local time.

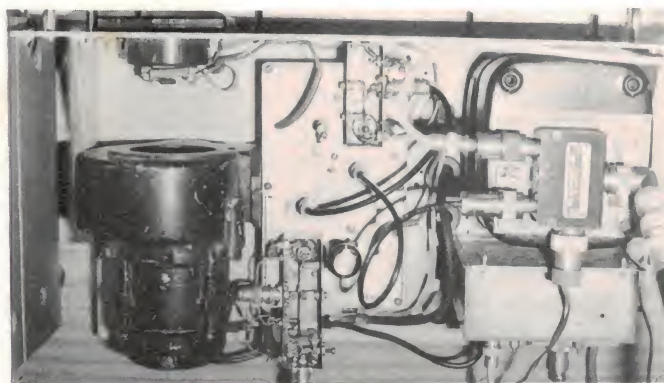
A similar opening occurred on 8 February, with signals to strength nine (S9), lasting until after midnight. The next morning (9 Feb.), Dick tried 432 MHz and contacted ZL1AVZ at 0630 local time. As signals were readability five, strength nine (5 x 9 — or 'clear as a bell') the New Zealand station suggested trying 1296 MHz. Dick, VK2BDN, ran carrier on 1296 MHz whilst he had breakfast. At 0745 Sydney time, Brian ZL1AVZ reported on 432 MHz that he was receiving Dick's 1296 MHz carrier.

Dick then called on 1296 MHz SSB and a two-way contact to ZL1AVZ ensued over a period of

20 minutes. Brian, ZL1AVZ, used CW and SSB. Dick received Brian at 5 x 2, Brian received Dick at 5 x 3.

The contact, apart from possibly establishing a few new records, was remarkable when you consider the equipment. ZL1AVZ was running a Microwave Modules transverter and a 4 m diameter dish. VK2BDN was using a 'homebrew' 2C39 (lighthouse tube) mixer driving a 2C39 linear amplifier. His receiver employed a Microwave Modules preamp and converter, 144 MHz IF. Antennas were two 27-element loop yagis. QSL cards have been exchanged.

Dick received assistance and encouragement from Geoff Campbell, VK2ZQC. Well done, gentlemen! Dick's next attempt will be on 2300 MHz.



Inside the 1296 MHz transverter; transit mixer and amplifier in the centre, receiving converter at lower left.

Space age plastic for coax seals

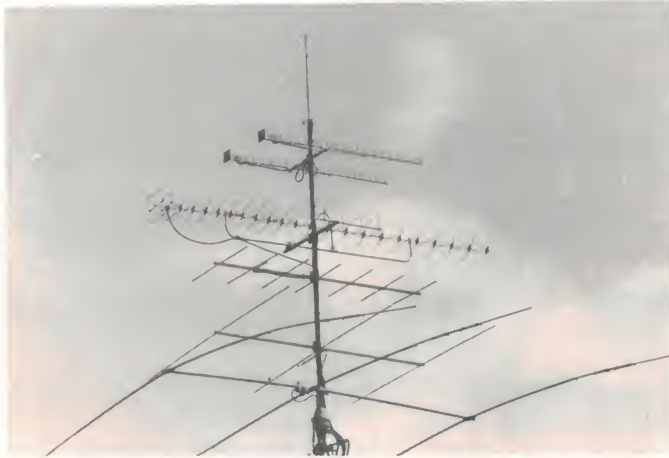
Coax-Seal is a new 'space age' plastic material which is said to seal all types and shapes of coax fitting quickly and effectively.

It is claimed to stay flexible for years, ensuring moisture-proof connections, good SWR and long coax life. It allows quick disconnection and resealing of fittings, and will adhere to vinyl and polyvinyl coax outer covers.

Coax-Seal may be used to seal through wall runs, on baluns, beam antenna parts, di-

poles and connections, and is non-toxic, non-conducting, non-corrosive and versatile.

Coax-Seal is supplied in industrial rolls, 1/16" x 1/2" wide (1.6 x 12.5 mm) on peelable backing paper, 50' (15.25 m) roll for use by CATV installers, microwave work and other installation uses.



The 1296 MHz loop yagi antennas can be seen atop the tower.



New Univolt digital multimeters

Two new handheld multimeters from Univolt have been released here recently through IFTA, who hold the Univolt agency.

Model DT-830 features a single large rotary switch for range selection, 30 measurement ranges, transistor and diode checkers, a continuity 'beeper' and a 3 1/2-digit liquid crystal display. On ac and dc voltage ranges it covers 200 mV to 200 V in four steps, plus an extra step to read 1000 V on the dc range and 750 V on the ac range. On dc and ac current, the DT-830 covers 200 μ A to 10 A. It has six resistance ranges from 200 ohms to 20 M full scale. Projected retail price is \$90 or so.

The DT-840 is an auto-ranging instrument featuring 20 measurement ranges, including a 'low ohms' range, with beeper. The DT-840 also features a 3 1/2-digit LCD like the DT-830, and

has a simple four-position switch in the front to select the quantity to be measured (volts-resistance-current). This one is expected to retail for \$45 or so.

We've had the opportunity to use and evaluate these instruments here at ETI and found them well-made, easy to use and accurate. The DT-830 makes a very handy lab or bench instrument, while the DT-840 is an excellent instrument for the general experimenter or service technician. They're worth a jolly good look if you're after a digital multimeter.

Further details from IFTA, P.O. Box 21, Bondi Beach NSW 2026. We note they also have a range of analogue multimeters to suit a variety of applications and budgets.

ERRATA

Short Circuits, Autostart & etc for ETI-730 RTTY Decoder: the author, Ralph Youie, writes: "I draw your attention to an error indicated to me by Ken, VK3ALC, on page 64 of January 1982 ETI. All references to Q1 in the article should refer to Q2, BF338, as there is no way that the circuit will work as shown. If there are difficulties in obtaining the correct waveform at the output of IC7, it may be necessary to change the 56k resistors to 68k, and the 8k2 resistor to 10k. Also note that pin 1 and pin 16 of the CMOS hex inverter should go to +12 V and pin 8 to 0 V."

Intruder alarm systems

Every three minutes a home or business in Australia will be burgled this year. With statistics like this, it's not surprising that people from all walks of life are becoming more security conscious and are turning to intruder alarms to protect their property.

The commercial consequence of this is that consumers are faced with a wide, and possibly confusing, array of equipment and services which may not give them enough information for their specific needs.

The Standards Association of Australia has just published a draft standard, DR 82022, on which it is seeking public comment, which provides guidance to the layman on the selection of intruder alarm systems in domestic and business applications. SAA believes that the availability of such a standard will improve general security because users will be better informed and capable of selecting an alarm system more suitable for their requirements.

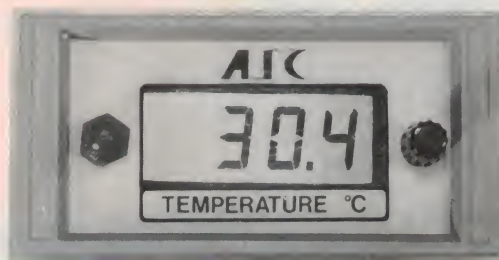
The main feature of the proposed standard — a simple to

understand publication to assist non-technical users — is the listing and explanation of the various alarm systems available, with details of the advantages and disadvantages of each type of system.

Technical terms have been kept as simple as possible, as it is intended that this proposed standard will be used by householders and business people who may have no technical background.

Attention is drawn to the fact that this is a draft only and is liable to alteration in the light of comment received.

Copies of DR 82022 can be obtained (free of charge) from any SAA office in all state capitals and Newcastle, and comment should be received before April 30 1982.



Two new products from AIC

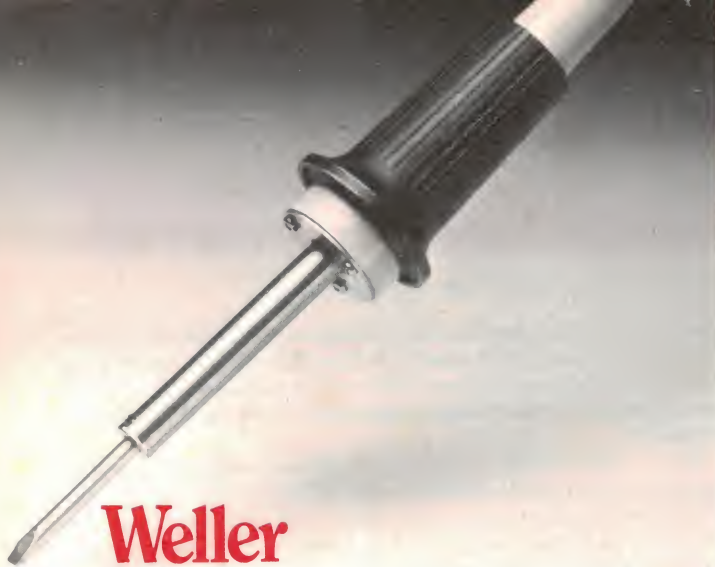
Amalgamated Instrument Co recently increased its range of controllers and meters with a low-cost temperature controller and an mV-ph-temperature meter.

Australian designed and manufactured, the panel temperature controller features digital display of process and setpoint, and has facilities for an additional alarm relay and a recorder output. The panel cutout size is only 45 x 92 mm, and the controller can be supplied to suit many other applications other than temperature.

The handheld mV-ph-temperature meter is also designed in Australia, and is said to be simple to operate, with such features as

clicking the power switch. All switching is carried out electronically, and the meter retains the last function selected in its memory. It may be used as a digital thermometer or a selective ion meter, and has automatic temperature compensation for pH and an automatic low battery indicator.

For further information contact AIC Pty Ltd, Unit A, 59 Myoora Rd, Terrey Hills (P.O. Box 134, Terrey Hills) NSW 2084. (02)450-2661.



Weller



Weller

The Tools. from Cooper The Toolmaker.

Weller industrial SPI non-temperature controlled line voltage soldering irons, with iron plated copper tips, stainless steel barrels. Impact and heat resistant handles are lightweight.

Available as SPI25D 25 watt or SPI40D 40 watt irons.

The Weller WTCPN soldering station is temperature controlled and combines high volume capability with precision performance. The low voltage TC201 soldering pencil employs the exclusive "closed" loop method to control maximum temperature and protect sensitive components.



Lufkin

Official Supplier of
Measuring Tapes to the
XII Commonwealth Games
in Australia 1982



The Cooper Group

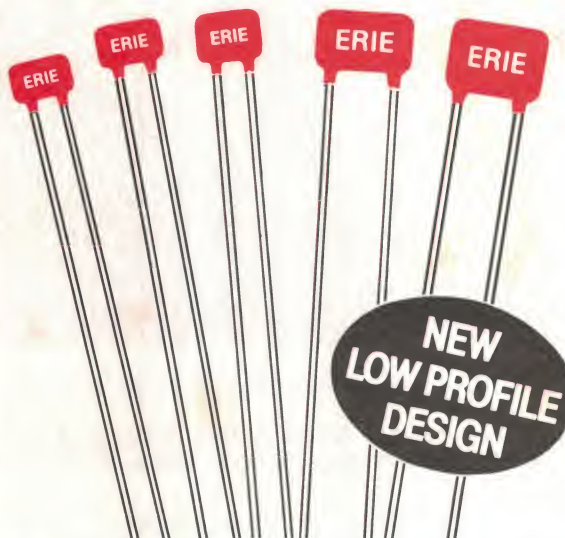
CRESCENT-LUFKIN-NICHOLSON-PLUMB
WELLER-WISS-XCELITE

The Cooper Tool Group Limited
P.O. Box 366, Nungong Street
Albury NSW 2640, Australia
Tel 215511 Telex 56995

ERIE

MONOBLOC®

**World's most popular
Ceramic Capacitors**



Monolithic construction
X5U Temperature range -55°C to +85°C

ERIE Red Cap Monobloc® Ceramic Capacitors are in a quality class by themselves and today represent a standard of excellence unequalled in the industry.

Monobloc capacitor elements, solid structures of fused ceramic, are produced in a wide range of capacitance values.

They offer inherent stability with conservative voltage ratings for long, trouble-free life.

The new low-profile construction, with height reduced by 1/3rd compared with other monolithic types, has been designed specifically for the innovators of the electronics industry. These ceramics are ideal for compact designs and will play a significant role in high density applications.

Volume delivery ex-stock in these popular values.

.01uF, .047uF, .1uF, .22uF, .47uF, 1.0uF.

Technical information available on request.

SOANAR

Soanar Electronics Pty Ltd

A member of the A & R Soanar Electronics Group
30 Lexton Road, Box Hill, Vic., 3128, Australia

VICTORIA: 840 1222
N.S.W. 789 6733
Sth. AUST: 42 8918

QUEENSLAND: 52 1131
WEST. AUST. 381 9522
TASMANIA: 31 6533

Tough times for tantalums

Tantalum pentoxide (Ta_2O_5), the base material for tantalum capacitor production, was in short supply during 1979/80, when it cost \$120-\$150/lb, but has recently slumped to under \$50/lb after a considerable slackening in demand following developments designed to reduce usage.

Tantalum capacitor production accounted for around 45% of total world consumption of Ta_2O_5 last year. The 1979/80 shortage brought rapidly escalating prices for the material and the final product, and stimulated some technical and economic developments aimed at reducing usage of Ta_2O_5 in tantalum capacitors and producing alternative capacitor types.

The capacitance capability of tantalum powder was improved, reducing the quantity necessary for capacitor production, and developments in low-leakage, lower-cost aluminium electrolytic capacitors led to a reduced demand for tantalum types. Ceramic capacitors also found application in electronics where tantalums were previously specified, again wearing away at the market demand for tantalum.

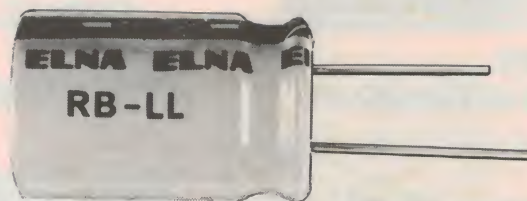
Japanese capacitor manufacturers reacted very sharply to the 'shock' $3\frac{1}{2}$ -fold increase in the price of tantalum powder during 1980. From 1976, production had grown at a rate between 22-33% a year. Electronic equipment manufacturers took steps to reduce the number of tantalum capacitors used, with the result that in the first four months of 1981 aluminium capacitor usage increased by some 30% over the same period

the previous year, and ceramics by some 22%. Growth in tantalum usage at that time was a mere 0.05% (about 1.5%/year), where it had been 8% annually for the past decade.

Tantalum powder is also used in the aerospace and chemical industries and demand in these areas is expected to grow. If the video industry, currently falling short of growth targets, expands as expected, then demand for tantalum from the electronics manufacturers will increase beyond current levels as tantalum capacitors are heavily used in video equipment.

Despite the gloomy outlook, at least for the short term, mining companies are gearing up for increased production. Tantalum output from all sources world-wide was 1500 t in 1980 and is projected to be almost 2200 t by the year 2000. Primary sources such as the West Australian Greenbushes Tin mine and the Canadian Bernic Lake mine have commenced substantial expansion programmes. Other producers are gearing up to recover tantalum from the slag of old tin mines — principally in Brazil, Thailand and Malaysia.

Greenbushes Tin NL is reported to dominate future prospects as it holds a major deposit in West Australia ex-



The low-leakage aluminium electrolytic was developed to replace tantalums — but can only do so in some areas.

pected to come on stream in 1983, producing a reported 68 t of Ta_2O_5 in its first year, rising to 340 t by 1986.

By 1985 Australia's total output of tantalite is expected to be twice that of the Bernic Lake

mine, the largest producer at present. Tin slags, however, remain the world's largest single source of tantalum at the moment, accounting for some 40-50% of annual supplies.

Applied Technology to concentrate on small buyer

Applied Technology is already well-known for its range of Z80/S100 products, and recently purchased the remaining stocks of the 'Silicon Valley' chain to add to its status as a supplier of semiconductors to the small-scale buyer.

Applied Technology began supplying this market in 1975 with its 'Electronic Mailbox', and is now promoting its Telephone Hotline service, which will operate from one outlet only in Hornsby. By thus centralising semiconductor supply it is much easier for AT to keep complete stocks and operate with lower prices.

Computer management of

sales and ordering has also been installed, and the use of telephone/credit card facilities is expected to become extremely common, benefitting the customer with faster despatch times and no waiting for goods to come into stock.

For further information contact Phil Gleeson or Owen Hill on (02)487-3798.

Flat pocket TV old hat

No sooner had our October issue with the article on Clive Sinclair's flat pocket TV tube and receiver appeared in the newsagents than a reader, M. Chevallier of Killara NSW, appeared on our doorstep with a 1966 news item on the subject.

What's more, the news item, from Popular Mechanics of April '66, was about a colour tube! It seems that a Los Angeles firm, Intertel Corp, had developed a flat colour picture tube with a 150 mm (6") screen and only 60 mm thick. They had a monochrome version, too. The man responsible was engineer Leo Shanafelt.

The operating principle was different to Sinclair's recent development. The colour tube had two faces — one with a red-orange phosphor and one with a blue-green phosphor. Deflection plates were deposited on the faces between the phosphor

and the glass of the tube. The deflection plates on the red-orange phosphor face were transparent, and this formed the viewing face. Two electron guns were used, mounted at the bottom of the tube. Deflection was achieved by a magnetic yoke around the base of the tube. The electron beams were arranged to strike the appropriate phosphor as required. But, as only two phosphors were used, only limited colour was achieved.

Interesting. Many thanks to Mr. Chevallier for bringing the item to our attention.

Breadboards

The Sydney-based firm of Emona has recently gained the agency for A-tek prototyping breadboards.

These breadboards are just the thing for 'proofing' or experimenting with a circuit design. Components, including DIL ICs, just plug in, and interwiring is partly done by the breadboard and partly by using single-strand hookup wire between 20 and 29 AWG.

The A-tek breadboards are

obtainable in terminal strip and distribution strip pieces which may be 'snap-locked' together, in a range of sizes from 100 to 1920 tie-points. Prices range from around \$2 to around \$40.

Details from Emona, CBC Bank Bldg, 661 George St, Haymarket Sydney. (02)212-4851.

Bill Edge's ELECTRONIC AGENCIES

115 Parramatta Road,
Concord 2137
Ph 745 3077
123 York Street,
Sydney 2000
Ph 29 2093
Mail Orders: P.O. Box 185
Concord 2137

NEW TRADING HOURS BOTH STORES

Mon-Fri 9-5.30 p.m.
Thurs till 8 p.m.
Sat 9-12 midday

MAIL CHARGES

\$5-\$9.99.....	\$1.00
\$10-\$24.99.....	\$2.00
\$25-\$49.99.....	\$3.00
\$50-\$99.99.....	\$4.00
\$100 or more.....	\$5.50

All heavy or bulky items (over 20 kg)
sent Comet road freight \$8.00, any-
where in Australia

ETI 670 ASCII KEYBOARD KIT



\$130 KE6606

ETI 469 DRUM MACHINE



\$89 KE1075 incl. case

COMING SOON

ETI MIXING CONSOLE

NEWS FLASH!

We now stock every Printed circuit
board published by EA & ETI going
back to Jan 1975. Available in both
stores.

APRIL EA KITS

VOICE CANCELLER
KE1155
\$20.00

FUNCTION GENERATOR
KE4095
\$85.00

VOICE OPERATED RELAY
KE1130
\$15.00

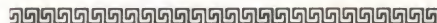
APRIL EXPANSION SPECIALS

AE1000 Built up 240V strobe Don't
pay \$36 only \$19.99
DE3015 3' Helical Whip 1/2 price \$6.25
DE3017 5' Helical Whip 1/2 price \$8.25
DE3025 6' Helical Whip save \$6 \$12.50
DE075140 ch. Super Lynx CB
save \$25 \$114.00
KE2050 Stylus Timer Kit
save \$20 \$27.95
LE8570 Seco Alarm Module

save 20% \$23.60
ME7721 240V to 3, 6, 9, 12V 300mA
save \$4 \$5.75
ME7735 240V to 3, 6, 9, 12V 1 Amp
save \$8 \$18.00
NE4727 1mm Solder 200g roll
save \$1 \$3.95
QE5231 Univolt DT830 LCD Digital
Multimeter with transistor checker
save \$10 \$79.95

RE2648 — 1 Greencap 100V
save 60% \$0.10 ea
ZE5206 XR2206 save \$2 \$4.50
ZE4001 4001 1c save 30% \$0.20
ZE4011 4011 16 save 30% \$0.20
ZE5555 NE555 save 8c \$0.2
ZE6012 7805 T0220 save 30c \$0.80
ZE6012 7812 T0220 save 30c \$0.80
ZE6015 7815 T0220 save 30c \$0.80

COMPARE OUR NEW PRICES ON SEMICONDUCTORS, RESISTORS, CAPACITORS, PLUGS & SOCKETS.



ELECTRONIC TECHNICIANS

We require the services of several
electronic technicians to work in our
Service Department at North Ryde.
The work involves repair of an enor-
mous variety of electronic equipment
in our air conditioned workshops.
Applicants should ideally possess the
E&C certificate, have had several
years experience in the industry and
be able to work without supervision.
Salary negotiable and generous staff
benefits apply. If you think that you're
the person that we need, please apply
in writing to:

Gary Crapp
Service Manager
DICK SMITH ELECTRONICS
P.O. Box 321, North Ryde
N.S.W. 2113.



NEW ADDRESS VIDEO

MAIL ORDER DEPT.:
P.O. BOX 254, HEIDELBERG, 3084
Phone (03) 435 3004. Mon.-Sat. 1-6 p.m.

SAMPLE OF NEW SOFTWARE TITLES FOR OHIO

G3	Slalom & Hammuradi	\$7.95
G53	Motor Cross (Evel Knievel)	\$7.95
G54	Scanner (10 levels)	\$6.95
U12	Graphics Plotter (creates DATA statements)	\$7.95
U28	Forth — 2 tapes only	\$34.95
U29	Forth — 2 tapes & 3 books	\$49.95
T6	Forth — 3 books only	\$19.95
U41	Basic Line Remover	\$6.95
I32	J4 for Series 2 (for Joysticks, etc)	\$1.95
D3	Rocket To The Moon (2 1/2 min. action display)	\$7.95
E16	Slimming	\$9.95
E17	Hangman (spelling game)	\$9.95
E18	Life Expectancy	\$9.95

SAMPLE OF OHIO HARDWARE:

H24	R.F. Modulator	\$19.95
H25	Power Supply Unit 5V, 5 Amp, Reg.	\$59.00
EP1	PASCAL-2 x EPROM (Mother Board)	\$39.00
EP2	DABUS (Monitor ROM) — Cursor Controls & Single Key Basic	\$25.00

SAMPLE OF OHIO BOOKS

K1	Hardware Catalogue (incl. P&P)	\$1.00
K2	Software Catalogue (incl. P&P)	\$1.95
T1	The First Book of OSI	\$16.95
T2	Aardvark Journal Subscription	\$10.95

Allow Postage on Software —
1-2 items \$1.00 6-9 items \$2.00
3-5 items \$1.50 10 or more \$2.50

INTELLIVISION CARTRIDGE SWAP CLUB

Membership (Free to our customers) ... \$20.00
100% Submitted, complete Boxed Cartridge \$20.00
No Draughts — Free P&P.
All Prices include Sales Tax.
Prices subject to change without notice

TRY THIS EXCITING HOBBY!

Build your own Organ, at
half the cost of a
ready-built Organ.

WITH WERSI ORGAN KITS

Wide range of models:
COMBO to large CHURCH ORGANS



Also
available
ready-built.

- STRING ORCHESTRA
- BASS SYNTHESIZER
- ELECTRIC PIANO
- and the famous WERSI VOICE ROTATION SOUND

For a Colour Catalogue send 80c.
Klaus Wunderlich Demonstration Record, music only with jacket
notes — \$7.00 (incl. postage.)

CLEFTRONICS PTY. LTD.

9 Florence St., Burwood, Vic. 3125
Phone: (03) 288-7899

TOOLKIT & TOOLS TO WIN!

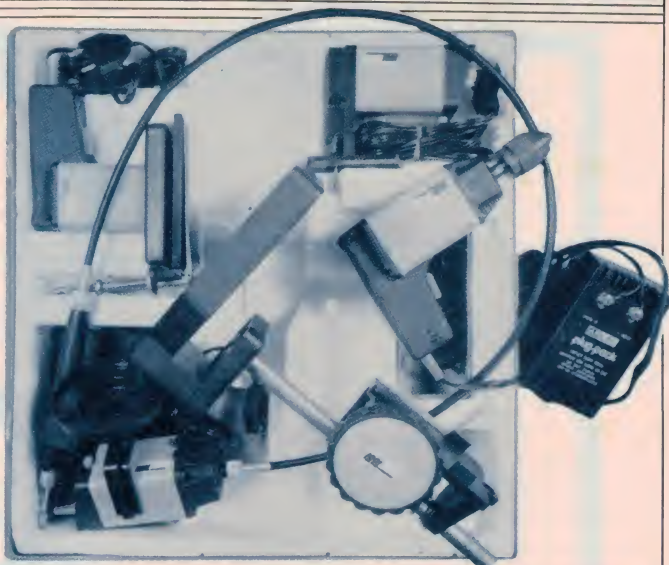
**OVER \$350
IN PRIZES!**

from Minitool Australia Pty Ltd
in this simple-to-enter contest.

There's nothing like a set of good tools to help give that professional finish to projects and models. A craftsman is only as good as his tools, the old saying goes. Here's your chance to obtain some first-class tools for yourself. All you have to do is answer the four simple questions below, write a short essay, fill in the coupon and send in your entry — or several, if you wish! What could you win? Here's the list of prizes:

- 1st Prize:** Minitool Workshop Kit, 000-62-90X, comprising pistol drill, drill stand, flexible shaft unit, orbital sander, jig saw, spare blades, table clamp, platform table, power pack and carry case (rrp \$187.50).
- 2nd Prize:** Pistol drill, drill stand, flexible shaft unit and power pack (rrp \$134 total).
- 3rd Prize:** Pistol drill, orbital sander and power pack (rrp \$89 total).

This contest is sponsored by ETI and Minitool Australia Pty Ltd, who have kindly donated the prizes.



Illustrated here is the super first prize — a complete Minitool Workshop Kit. This and the range of other Minitool tools were featured in News Digest on page 8 of the December 1981 issue of ETI. All the tools operate from a 12 Vdc source (a good safety feature), either battery or plug pack, and are designed to suit fine work in handheld or mounted applications.

RULES

This contest is open to all persons normally resident in Australia with the exception of members of the staff of Minitool Australia, Murray Publishing, Offset Alpine, Australian Consolidated Press and/or associated companies.

Closing date for the contest is 31 May 1982. Entries received within seven days of that date will be accepted if postmarked prior to and including 31 May 1982.

The winning entries will be drawn by the Managing Editor of ETI, whose decision will be final. No correspondence can be entered into regarding the decision.

Winners will be advised by telegram the same day the result is declared. The name of the winners, together with the winning answers, will be published in the next possible issue of ETI.

Contestants must enter their names and address where indicated on each entry form. Photostats or clearly written copies will be accepted but if sending copies you must cut out and include with each entry the month and page number from the bottom of the page of the contest. In other words you can send in multiple entries but you will need extra copies of the magazine so that you send an original page number with each entry.

This contest is invalid in states where local laws prohibit entries.

Entrants must sign the declaration, accompanying this contest, that they have read the above rules and agree to abide by their conditions.

You may enter as many times as you wish but you must use a separate entry form for each entry and include the month and page number cut from the bottom right hand portion of this page. You must put your name and address on the entry form and sign it where indicated.

Please read the contest rules carefully, especially if sending multiple entries.

QUESTIONS

1. When drilling holes in a pc board, stability is essential to avoid breaking the very small drill bit. Thus, it would be best to hold the pistol drill in —

- ☐ your hand.
- ☐ a vice.
- ☐ the drill stand clamped to a bench.
- ☐ the dog's mouth.

2. When cutting a large hole in a panel to fit a meter, the hole is quickly and neatly cut by —

- ☐ drilling a circle of holes and filing around them.
- ☐ using a jig saw.
- ☐ using a 'nibbling' tool.
- ☐ getting the dog to chew it out.

3. Power tools for hobbyist use are most safely powered from —

- ☐ a 1500 V dc supply.
- ☐ a 240 V ac supply.

- ☐ a 415 V ac supply.
- ☐ a 12 V dc supply.

4. A flexible shaft unit for a drill is most useful for —

- ☐ doing dental work on the dog.
- ☐ drilling in awkward places where a pistol drill won't reach.
- ☐ drilling around corners.
- ☐ drilling something you're too lazy to hold in a vice.

• On a separate sheet of paper, tell us in 50 words or less what feature or features of Minitool tools attract you and how this applies to your intended application or applications.

Name

Address

Postcode

Send to: ETI/Minitool Contest, 15 Boundary St, Rushcutters Bay NSW 2011.

I have read the contest rules and agree to abide by their conditions.

Signature

Tan



WHERE ELSE Can you get a complete 5M Byte hard disk add on for around **\$2,950 (Inc. Tax).**

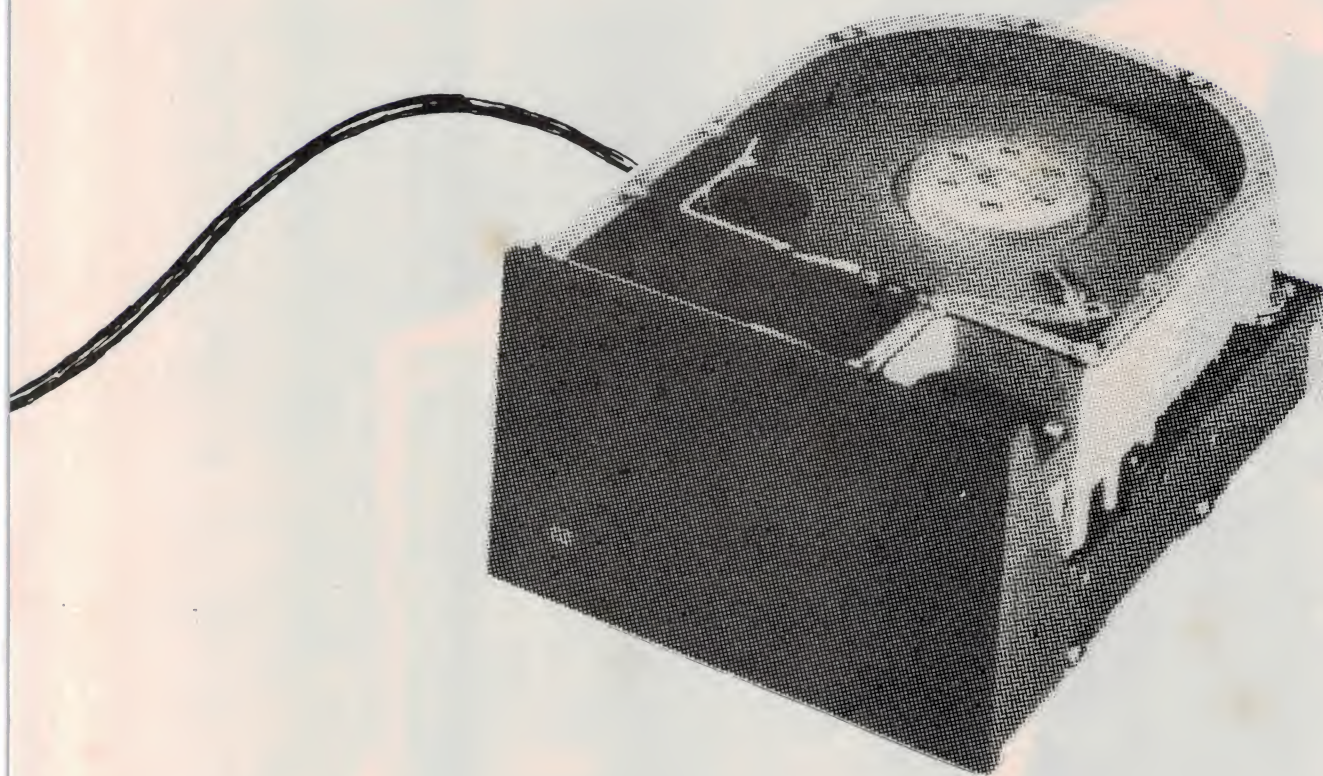
FOR

APPLE — TRS 80 — CROMEM

Software also available

AE ADAPTIVE
ELECTRONICS P/L

don



CO — S 100 — YOUR SYSTEM.

ADAPTIVE ELECTRONICS ARE THE SOLE AUSTRALIAN DISTRIBUTORS

Immediate Delivery — Boxes and Power Supplies also available.

For Further Information contact MARTIN COLLETT on (03) 267 6800

Dealer Enquiries Welcome.

418 ST. KILDA ROAD, MELBOURNE, VICTORIA, AUSTRALIA, 3004
TELEPHONE: (03) 267-6800

TELEX: AA32565

INTRODUCING

PETERSON "MODEL SIX" MONITORS

*120 Watt RMS *+—3db Accuracy—95db 1 watt 1 metre

for people who want to
"feel" the cannons on
the 1812, experience
the clarity of a
solo flute

R.R.P. \$795 pr.

VIC

Clive Peters, Ringwood & Mt Waverley
Frankston Sound Brashs, City
Reliance Hi-Fi, Footscray
Mildura Audio, Mildura
Gleeson and Tonta, Dandenong
Maryvale Electronics, Morwell
John Thomas, Ballarat
Roy Vincents Audio, Echuca
Denman Audio, St. Kilda

NSW

Orange Audio, Orange
Car Radio & Hi-Fi, Wagga Wagga
The Record Centre, Griffith
Brian Bambach, Newcastle
Kent Hi-Fi, Canberra
Nitronics, Coffs Harbour
W.A.
High-Fidelity Stereo, Perth

QLD

Queensland Entertainment Co/P/L
Eight Mile Plains
and Charlotte St. Brisbane
SA
Track Hi-Fi, City
Ern Smith, Norwood
Astra Hi-Fi, Woodville South
O'Connells, Country

WE NOT ONLY HAVE THE GOODS — BUT AT THE RIGHT PRICES TOO!!

POST AND PACKAGING EXTRA WHERE NOT SHOWN

NEW SHIPMENT OF BRITISH MADE THUMBWHEEL SWITCHES

1 Pole 10 pos. type
size 58 x 12mm
Grey Moulding

1 to 9 \$2.25 each 10 plus \$2.00 each
100 plus \$1.60 each

\$100 EDGE CONNECTORS

AT A CRAZY
CRAZY
PRICE

(Solder spill contacts)

ONLY \$4.50 or 10 for \$40.00

NEW! LOW EXTRACTION FORCE SOCKET QIJEJECT™

- Eliminates real risk problems in handling, soldering and service.
- Exclusive GTH™ based contacts for high reliability.
- Compact size for high density packaging.
- Available 24 positions.
- High temperature, self-extinguishing, thermoplastic body meets UL 94-V-0 rating.
- Accepts gold, tin or silver plated I.C.'s.

FOR ALL LSI AND
MICROPROCESSORS
PACKAGES



BURNDY \$4 each or 10 for \$36

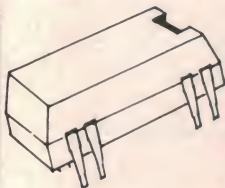
NEED A MINI-SIZE, HIGH-POWER, 5-BAND EQUALIZER BOOSTER

For your car? you do — well this Phodis PH 5250 is just for you

Look at these features • 30 watts per channel at 4 ohms • Transformerless direct-coupled "Bridge" type BTL Circuit • 20-20,000 Hz frequency response • Switch for boost/bypass • 5 LED power wattage meter • Switch for 2 or 4 speaker selection • Choke added externally for noise suppression • Small size 135mm x 90mm x 30mm. Twelve Months Guarantee

WAS \$57.95 NOW ONLY \$45 TO CLEAR

ELECTROTHERMAL MINI-DIP, DUAL-IN-LINE REED RELAYS, TYPE GR108A2



Specs: SPST 12vdc.
Coil-Resistance, 1100 ohms.
Nom. Current, 11mA.
Pull-in Voltage, 8Vdc.
Contact rating, 500mA.

ONLY \$1 each
10 +, 90c
100 +, 80c

CRAZY! CRAZY! CRAZY!

LOOK AT THESE PRICES FOR COMPUTER CHIPS

TYPE	EACH	10+
2708	4.90	4.40
2114-3	2.20	2.00
4116-2	2.00	1.80
2716	5.50	5.00
2532	9.00	8.10
2564	22.00	20.00
6116-150	10.00	9.00
4 MHz CPU-Z80A	11.00	9.90
2.5 MHz P10-Z80	6.75	6.00
2.5 MHz CTC-Z80	6.75	6.00

NOW HERE'S A HUMDINGER OF A BARGAIN —

'KAISE' MULTIMETER

MODEL SK-22 20,000Ω/V DC
10,000Ω/V AC

SPECIFICATIONS

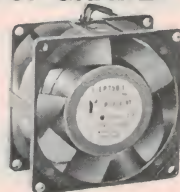
DC Volt: 0.25, 2.5, 10, 50,
250, 1000 Volts
AC Volt: 10, 50, 250, 500,
1000 Volts
DC Current: 0.05mA, 2.5mA,
25mA, 250mA, 10A (SK-22
Only)
Resistance: 5KΩ, 500KΩ,
5MΩ
Decibels: -10 ~ +22, +36,
+50, +56, +62 dB
Accuracy: DC Volt ±3% (of
full scale)
AC Volt ±4% (of full scale)
DC Current ±3% (of full
scale)
Resistance ±3% (of full
scale length)
Battery: 1.5V (UM.3) x1
Size & Weight: 150 x 86 x
40mm, 280g
Accessories: 1 pair Test
Leads.



**NOW
\$19.95 TO
CLEAR
PLUS \$3
P&P &
REG.
WAS
\$39.95**

AXIAL COOLING FANS for 240 vac 50/60 Hz

TOP GRADE!!



DIM. IN MM
80x80x42
\$23
92x92x25
\$22
119x119x25
\$23
119x119x38
\$25

"Only The Best From Sheridan's"



**BOURNES 50K ohms Single Turn
Cermet Trimpots**
Type 3386.5W rating 1/4 sq.
Five for \$2.00 or 10 + 35c ea.

BANKCARD WELCOME HERE

BEST VALUE EVER!! SPECIALS!! IN AUDIO LEADS 2/3rds OFF NORMAL PRICE!

TYPE	DESCRIPTION	PRICE
A	5 Pole din plug to 5 Pole din plug	\$1.00
B	5 Pole din plug to 6.5mm Stereo line skt	\$0.45
C	2x3.5mm plugs 6.5mm Stereo line skt	\$0.45
D	3.5mm plug to 2x Alligator clips	\$0.70
E	5 Pole din plug to 2x Alligator clips	\$0.80
F	5 Pole din plug to 4x6.5mm plugs	\$0.95
H	3.5mm plug to RCA line socket	\$0.40
I	6.5mm Stereo plug to 2x6.5mm Stereo line skt	\$0.60
J	3.5mm plug to Bare Ends	\$0.25
K	5 Pole din plug to 3.5mm plug	\$0.50
L	6.5mm Stereo plug to 6.5 Stereo line skt	\$1.00
M	5 Pole din plug to 4 RCA plugs	\$1.00

(Ex-Stock) NATIONAL DATA BOOKS FOR YOUR LIBRARY

LOGIC DATA \$ 7.00
MEMORY DATAS 6.00
CMOS DATA \$ 9.00
INTERFACE
DATA \$ 9.00
LINEAR DATA ..\$10.50
AUDIO/RADIO
HANDBOOK \$ 6.75
DATA
CONVERSION
ACQUISITION ...\$ 8.00
POWER TRANSISTOR
DATA \$ 2.00
PLEASE ADD SUFFICIENT FOR P&P

Something
special & hard to
get VMOS power
FET'S (2N6658)
'N' Channel
enhancement
mode



only \$5.50 each
Limited quantities
only

HANDY 'TITBIT'



2 Way Terminal
Block. Polythene
Body-Brass Inserts.
10 for \$1.25 Worth Treble

'LAST CHANCE TO BUY' LIMITED STOCKS LEFT SANGAMO Computer Grade Electro's



CAP. MFD	VOLT	CASE SIZE	PRICE
1800	50	AA	\$ 3.50
2400	50	AA	\$ 4.00
3000	75	AD	\$ 5.00
3300	75	AC	\$ 5.50
4200	100	BC	\$ 7.00
4300	25	AA	\$ 3.75
5400	35	AB	\$ 4.25
7000	35	AB	\$ 5.00
8000	35	AC	\$ 6.00
9100	60	BC	\$10.00
10000	25	AB	\$ 6.50
18000	20	AC	\$ 5.00
20000	25	EC	\$ 8.75
30000	25	CB	\$13.00
36000	20	BC	\$ 7.75
39000	25	BF	\$10.00
65000	35	DF	\$20.00
67000	10	ED	\$12.50
76000	25	DD	\$22.00

CASE CODE	DIA.	HT.	PRICE
AA	34.93	53.98	\$ 1.00
AB	34.93	79.38	\$ 1.00
AC	34.93	104.78	\$ 1.00
AD	34.93	117.48	\$ 1.00
BC	50.80	104.78	\$ 1.50
BF	50.80	142.88	\$ 1.50
CB	63.50	79.38	\$ 1.75
DD	76.20	117.48	\$ 2.00
DF	76.20	142.88	\$ 2.00
ED	44.45	117.48	\$ 1.25

PLEASE ALL THESE CAP'S ARE NEW UNUSED
NOTE!! STOCK & ARE NOT EX-COMPUTERS

SEMICONDUCTORS AT WHOLE- SALE PRICES ... JUST COMPARE

		10+	100+
BC 547	NPN 45v 100mA 500mV	9c	7c
BC 557	PNP 45v 100mA 500mV	9c	7c
TIP 29B	NPN Power 80v 1A 30W	35c	30c
2N 3656	NPN 25v 50mA 200mW	10c	8c
5mm	Red LED'S	8c	6c
BZX83C12v	12V 250mW Zener Diode	10c	7c
BZX96C4V7	4.7V 1.5W	30c	25c
ITTDR7B	7.1V 1.1W	25c	20c
NEC ZD	5.6V 200mW	10c	8c
ZX 12	12V 15W Zener Diode	95c	80c
CD4001AE	CMOS I.C.	15c	12c

SHERIDAN ELECTRONICS

164-166 REDFERN ST, REDFERN, NSW 2016
TELE: 699 5922/699 6912. P.O. BOX 229, REDFERN

Power supplies and voltage regulators

In this first edition of our new Circuit File series, design consultant Ray Marston takes an in-depth look at practical power supply and voltage regulator circuits.

Ray Marston

TWO OF THE MOST common tasks facing the electronics designer or experimenter are those of designing basic power supply circuits to enable pieces of equipment to operate from ac power, and designing voltage regulator circuits to enable specific circuits to operate from well defined dc supply voltages over wide ranges of load current.

Both of these design tasks are reasonably simple. Basic power supply circuits consist of little more than a transformer-rectifier-filter combination, so all the designer has to do is select the circuit values, using a few very simple rules, to suit his own particular design requirements.

Voltage regulator circuits may vary from simple zener diode networks, designed to provide load currents up to only a few milliamps, to fixed voltage high current units for powering logic boards, etc, or to variable voltage high current units designed to act as general purpose pieces of test gear. We'll look at practical versions of all these examples in the next few pages.

Power supply circuits

Basic power supply circuits are used to enable pieces of equipment to operate safely from ac mains power (rather than from batteries), and are simply designed to convert the ac mains voltage into an electrically isolated dc voltage of the value required by the actual circuitry of the equipment.

The basic power supply circuitry consists of little more than a transformer-rectifier-filter combination; the trans-

former is used to convert the ac line voltage into an electrically isolated and more useful ac value, and the rectifier-filter combination is used to convert the new ac voltage into the appropriate dc value.

Figures 1 to 4 show the four most useful transformer-rectifier-filter combinations you will ever need. The Figure 1 circuit provides a single-ended dc supply from a single-ended transformer and bridge rectifier combination, and gives a virtually identical performance to the centre-tapped transformer circuit of Figure 2. The circuits in Figures 3 and 4 both provide 'split' or 'dual' dc supplies and, again, give virtually identical performance. The rules for designing these circuits are very simple, as you'll see in a moment.

Transformer-rectifier selection

The three most important parameters of a transformer are its *secondary voltage*, its *power rating*, and its *regulation factor*. The secondary voltage is always quoted in RMS terms at full rated power load, and the power load is quoted in terms of VA or watts (though VA is more widely used). Thus, a 15 V, 20 VA transformer will provide a secondary voltage of 15 V RMS when its output is loaded by 20 watts. When the load is removed (reduced to zero) the secondary voltage will rise by an amount specified by the *Regulation Factor*. Thus, the output of a 15 volt transformer with a 10% regulation factor (a typical value) will rise to 16.5 volts when the output is unloaded.

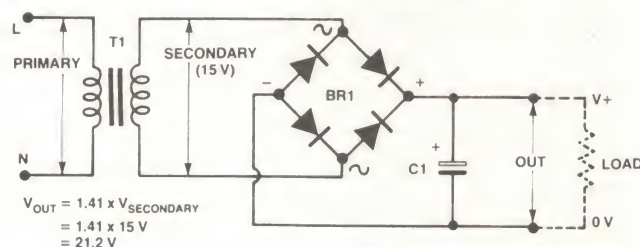


Figure 1. Basic single-ended supply using a bridge rectifier module.

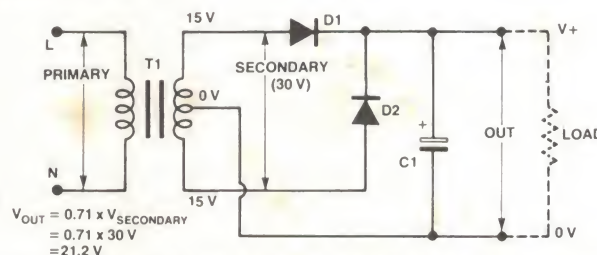


Figure 2. Basic single-ended supply using a centre-tapped transformer.

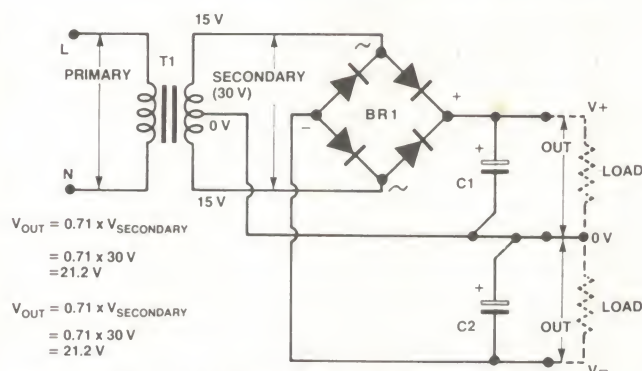


Figure 3. Basic dual supply using a bridge rectifier module.

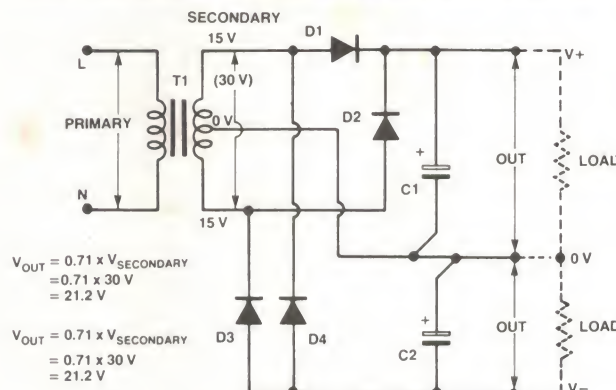


Figure 4. Basic dual supply using individual diodes.

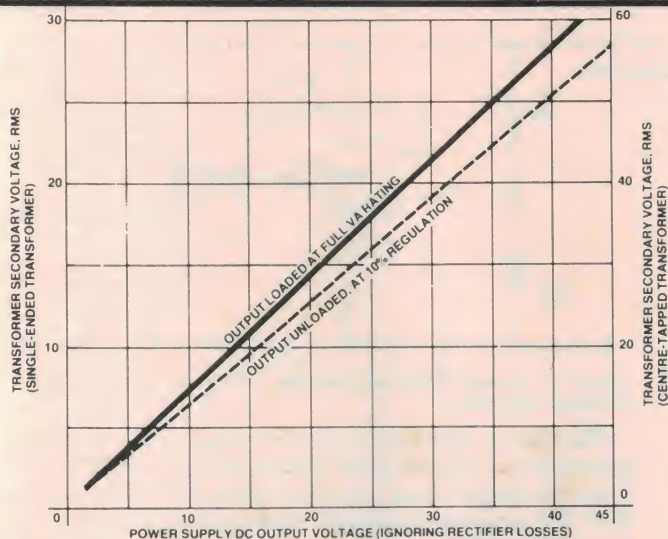


Figure 5. Transformer selection chart (see text).

Now, the most important point to notice here is that the RMS output voltage of the transformer secondary is *not* the same as the dc output voltage of the complete power supply. In fact, the dc output voltage of a fullwave rectified circuit is 1.41 (i.e.: $\sqrt{2}$) times the RMS transformer voltage (ignoring rectifier losses) that is feeding the rectifier, as shown in the graph of Figure 5. Note here that this voltage is equal to 1.41 times the voltage of a single-ended transformer. Thus our single-ended 15 V RMS transformer with 10% regulation will in fact provide an output of about 21 volts at full rated load (just under 1 amp at a 20 VA rating) and 23.1 volts at zero load.

When rectifier losses are taken into account, the output voltages will be slightly lower than shown in the graph. In the 'two-rectifier' circuits of Figures 2 and 4, the losses amount to about 600 mV, while in the 'bridge' circuits of Figures 1 and 3 the losses amount to about 1.2 volts. The rectifiers should, for maximum safety, have continuous current ratings at least equal to the dc output currents, but preferably greater.

Thus the procedure for selecting a transformer for a particular problem is very simple. First, decide on the dc output voltage and current that are required; the product of these two values (allowing for slight rectifier losses) determines the minimum VA rating of the transformer. Next, consult the graph of Figure 5 to find the transformer secondary RMS voltage that corresponds to the required dc voltage. Simple?

The filter capacitor

The purpose of the filter capacitor is to convert the fullwave rectified output of the rectifier — which consists of half-sinewave pulses — into a smooth dc output voltage. The two most important parameters of the capacitor are its *working voltage* and its *capacitance value*. The capacitance value determines the amount of ripple that will appear on the dc output voltage when current is being drawn from the circuit.

As a rule of thumb, in a fullwave rectified power supply operating from a 50 Hz power line, an output load current of 100 mA will cause a ripple waveform of about 700 mV peak-to-peak to be developed from a 1000u filter capacitor, the amount of ripple being directly proportional to the load current and inversely proportional to the capacitance value, as shown in the 'design guide' of Figure 6. In most practical applications, the ripple should be kept below 1-1.5 volts peak-to-peak under full load conditions. If very low ripple is required, the basic power supply can be used to drive a

three-terminal voltage regulator, which can easily reduce the ripple by a factor of 60 dB or so at very low cost.

Voltage regulator circuits

Voltage regulators may vary from simple zener-based circuits designed to provide load currents up to only a few milliamps, to fixed voltage high current circuits designed around 'fixed' three-terminal regulator ICs, or to variable voltage high current circuits designed around 'variable' three-terminal regulator ICs. We'll look at practical versions of all three types of circuit in the next couple of pages.

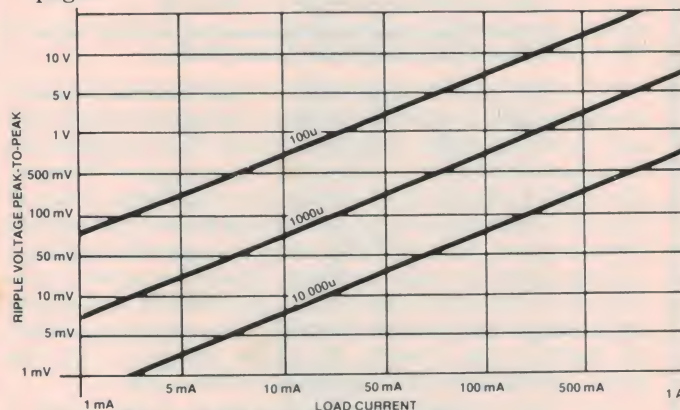


Figure 6. Filter capacitor selection chart (see text).

Zener-based circuits

A zener diode can be used to produce a fixed reference voltage simply by using the connections shown in Figure 7. Here, a current of roughly 5 mA is passed through the zener diode from the supply line via limiting resistor R. Often, the supply voltage (V_{in}) may be subject to fairly wide variations, causing the zener current to vary over a similarly large range. So long as V_{in} is always more than a few volts

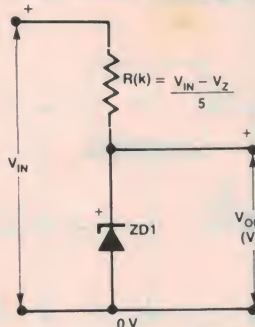


Figure 7. Basic zener reference circuit. Bias is about 5 mA.

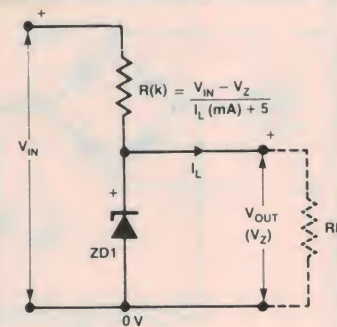


Figure 8. Zener reg. can supply load currents up to a few tens of mA.

greater than the zener voltage and provided that the zener power rating is not exceeded, this variation has only a moderate influence on the output voltage of the zener, which typically has an effective output impedance of only a few tens of ohms.

A zener can be used as a very simple voltage regulator, providing maximum load currents up to a few tens of milliamps, by merely selecting the value of 'R' as shown in Figure 8. Here, when the designed maximum load current is being drawn only 5 mA flows through the zener; when zero load current is being drawn the zener passes 5 mA plus the maximum designed load current, and thus dissipates maximum power. It is important to ensure that the power rating of the zener is not exceeded under this 'no load' condition. ▶

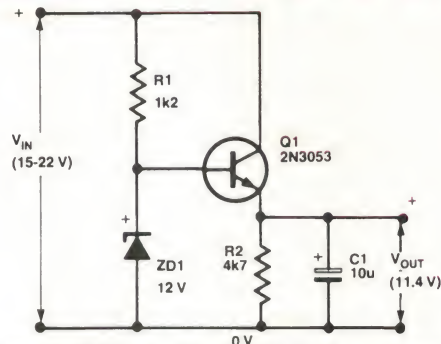


Figure 9. This series-pass, zener-based regulator circuit gives an output of 11.4 V and can supply load currents up to about 100 mA.

In most practical voltage regulator applications the zener is simply used to apply a 'reference' voltage to a high gain non-inverting buffer amplifier, which then supplies the required output power. The simplest example of this type of circuit is shown in the series-pass regulator circuit of Figure 9. Here, Q1 is wired as a voltage follower, its emitter remaining at about 600 mV below its zener-defined base voltage under all load conditions. The zener network provides the base drive current to Q1, this current being equal to the output load current divided by the current gain of the Q1 'buffer' stage. Clearly, the higher the gain of Q1, the better will be the output regulation of the circuit.

One way of improving the regulation of the Figure 9 circuit would be to use a Darlington or super-alpha pair of transistors in place of Q1. An even better solution is to use the op-amp plus transistor buffer stage shown in Figure 10. Here, the op-amp and Q1 are wired as a unity gain non-inverting dc amplifier with a near-infinite input impedance and near-zero output impedance. The output voltage tracks within a few mV of the zener reference value. The safe output current is limited to about 100 mA by the power rating of Q1; higher currents can be obtained if Q1 is replaced with a power Darlington transistor.

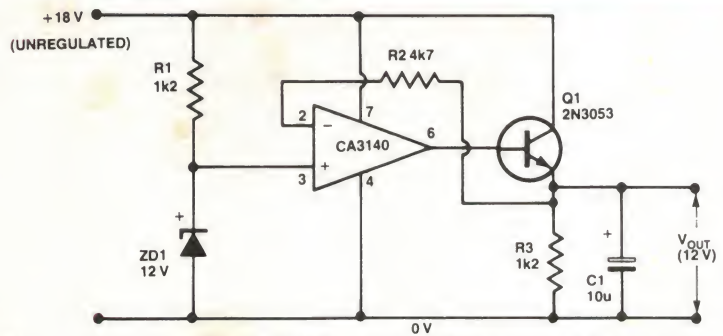


Figure 10. Op-amp based reg. provides 12 V at up to 100 mA with excellent regulation.

The Figure 10 circuit is very versatile. It can be made to generate any desired fixed voltage up to about 30 V maximum by simply using a suitable zener value and ensuring that the unregulated supply voltage is at least five volts greater than the zener value (up to 36 volts maximum). The circuit can be used as a variable voltage supply by simply wiring a potentiometer across the zener, with its slider taken to the non-inverting input of the 3140 op-amp; this op-amp can accept inputs all the way down to zero volts, enabling (for example) a 0-25 V supply to be easily implemented.

Fixed three regulator circuits

Fixed voltage regulator design has been greatly simplified in the last decade by the introduction of three-terminal regulator ICs such as the '78xx' series of positive regulators and the '79xx' series of negative regulators. These ICs incorporate features such as built-in foldback current limiting and thermal protection. A wide range of three-terminal fixed voltage regulator ICs is available; standard current ratings are 100 mA, 500 mA, 1 A, and 3 A, and standard output voltage ranges are 5 V, 6 V, 8 V, 12 V, 15 V, 18 V and 24 V.

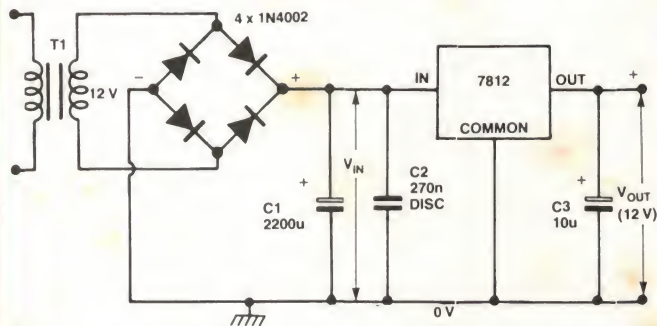


Figure 11. Circuit employing a common three-terminal positive regulator.

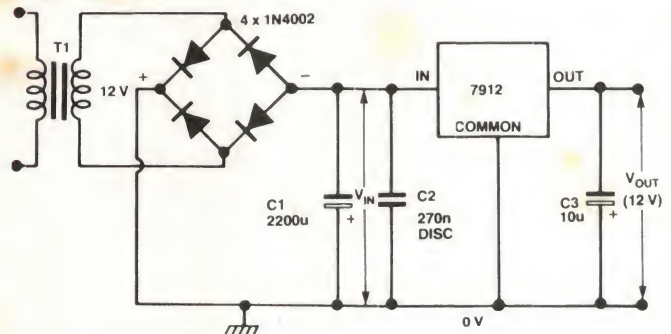


Figure 12. Circuit using a common three-terminal negative regulator.

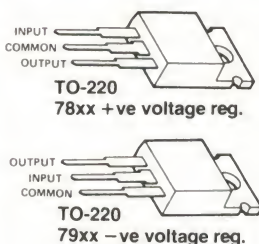


Figure 13. Complete circuit of a dual supply using three-terminal regulators. This supply delivers ± 12 V at up to 1 A.

Three-terminal regulators are remarkably easy to use, as shown in the basic circuits of Figures 11 to 13, which show the connections for making positive, negative and dual regulator circuits respectively. The ICs shown in these examples are 12 volt units with current ratings of 1 A, but the basic circuits are valid for all other voltage ratings, provided that the unregulated input voltage is at least three volts greater than the desired output voltage.

If the connection between the regulator's input and the rectifier's filter capacitor is more than 50 mm in length, then a capacitor is needed across the regulator's input terminals to maintain stability. Generally, all that is necessary is a 200n or greater value disc or plate ceramic capacitor, mounted right at the regulator's terminals using short leads. Alternatively a 2u2 or larger value tantalum could be used. You often see a capacitor connected across the regulator's output, too. Although not always necessary, a capacitor in this position reduces high frequency noise and improves transient response. A 100n or greater ceramic capacitor is recommended, or an electrolytic of 1u to 10u or so.

The output voltage of a three-terminal regulator is referenced to the 'common' terminal of the IC, which is normally (but not necessarily) grounded; most regulator ICs draw quiescent currents of only a few mA, which flow to ground via this 'common' terminal. The regulator output voltage can thus easily be raised above the designed value by simply biasing the 'common' terminal with a suitable voltage, making it easy to obtain 'odd-ball' output voltages from the regulator. Figures 14 to 16 show three ways of achieving this.

In figure 14 the bias voltage is obtained by passing the IC's quiescent current (typically about 8 mA) through RV1. This design is adequate in most applications, although the output voltage obviously shifts slightly with changes in quiescent current. The effects of such changes can be minimised by using the circuit of Figure 15, in which the RV1 bias voltage is determined by the sum of the quiescent current and the bias current set by R1 (12 mA in this example). If a fixed output voltage is required other than the designed value, it can be obtained by wiring a zener diode in series with the common terminal, as shown in Figure 16, the output voltage then being equal to the sum of the zener and regulator voltages.

The output current capability of a three-terminal regulator can be increased by using the circuit of Figure 17. Resistor R1 is wired in series with the regulator IC. At low currents, insufficient voltage is developed across R1 to turn Q1 on, so all the load current is provided by the IC. At currents of 600 mA or greater sufficient voltage (600 mV) is developed across R1 to turn Q1 on, so Q1 provides all currents in excess of 600 mA.

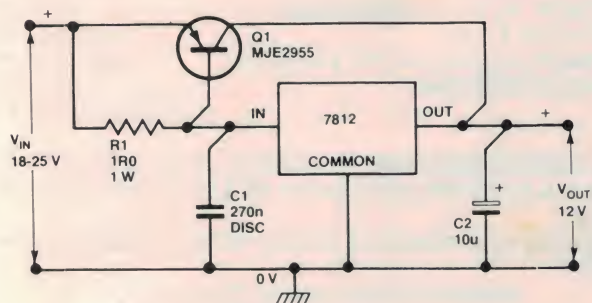


Figure 17. Increasing the output current capacity of a three-terminal regulator. This will deliver 5 A at 12 V.

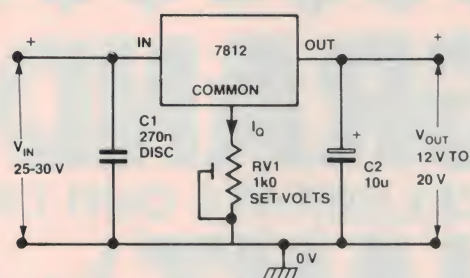


Figure 14. Simple method to vary output voltage.

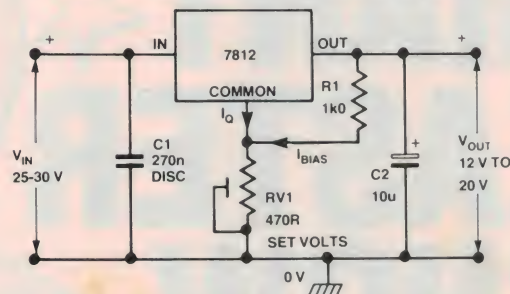


Figure 15. Improved method of varying output voltage.

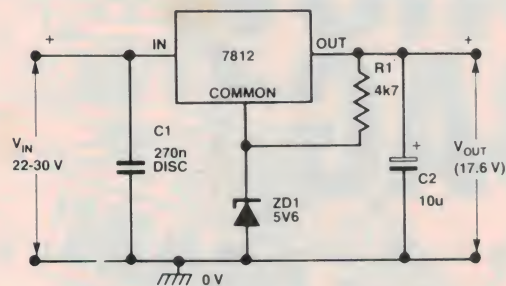


Figure 16. 'Jacking up' the output voltage using a zener.

Finally, Figure 18 shows how the bypass transistor of the above circuit can be provided with overload current limiting via an 0R12 current-sensing resistor (R2) and turn-off transistor, Q2.

Variable three-terminal regulator circuits

We've already seen that the outputs of '78xx' regulators can be varied over limited ranges by simply applying suitable variable voltages to their common or reference terminals, even though these ICs are designed as fixed regulators. If, however, you need to vary the output voltages over fairly wide ranges, a far better solution is to use one of the special variable three-terminal regulator ICs, such as the 317K or the 338K.

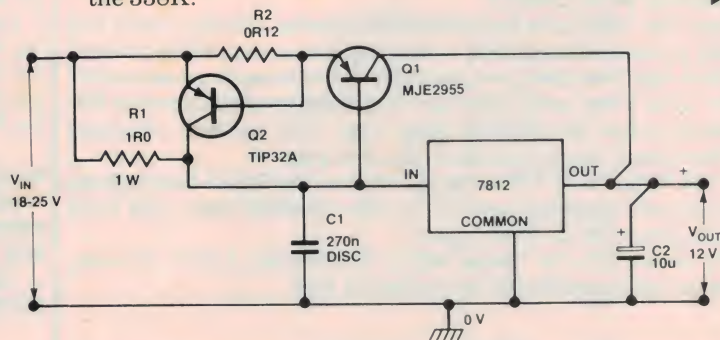


Figure 18. Providing overload protection for the Figure 17 circuit. Q2 'robs' Q1 of base current when load current goes above 5 A.

GRAND OPENING

TO CELEBRATE OUR OPENING AT 125 YORK STREET,

GIANT EASTER SHOW BAG

BACK AGAIN!

SHOP HOURS
Mon-Fri 9 to 5.30
Sat 9 to 3
Sun 10 to 2
Thurs night to 8pm



30mm SLIDE POTS
SACRIFICED

Ideal size for car or mixer Graphic Equalisers. 5K linear only.
QUANTITIES LIMITED!!

Were \$1.45
NOW 75 cents!!!

SAVE
70 cents

Speakers Slashed

High Power PA speakers slashed!!!!
Well respected Plessey/Foster brand.
12" 50W rms C300K05

Normally \$69.50
This month \$39.50
SAVE \$30.00

15" 240W rms C380K50

Normally \$245.00
This month \$175.00
SAVE \$70.00

Limited quantities on both types.

Save a fortune on our very popular Ioniser kits.

SHORT FORM Normally \$24.50
SAVE \$5.00 NOW ONLY \$19.50
FULL KIT Normally \$45.00
SAVE \$5.50 NOW ONLY \$39.50

Ioniser Kits



BELOW
COST!

UNBELIEVABLE SAMPLE BAG OFFER!

* A huge 20" x 10" bag FILLED with goodies

IT'S ON AGAIN! THE 1982 SHOWBAG

Greater value even than last year's great showbag — over 1000 sold! Even so hundreds of people missed out. If you want one this year get in EARLY.

Just like last year's bag it contains a comic, All-day sucker and lots of electronic goodies — we reckon over sixty dollars worth! Once again we could not normally sell this much componentry for such a low price. But the manufacturers have given us this merchandise far BELOW their cost! It's our way of saying "thankyou" for your help in our first year.

YOU WILL NOT FIND the showbag at the Royal Easter Show (hundreds tried last year). It is only available from 125 York St. Sydney OR by Mail Order.

We would like to thank V.S.I. Electronics, I.R.H. & many others who contributed to this year's bag.

only \$5.50

SORRY DUE TO
BULK POST &
PACKING \$1.50

THE BAG CONTAINS:

1 x bag of HARDWARE
1 x bag of RESISTORS
1 x bag of P.V.C. SLEEVING
1 x bag of KNOBS
3 x HOBBY ELECTRONICS MAGS
1 x MYSTERY KIT
1 x 2 WATT AUDIO I.C. W/- CIRCUIT
1 x PHANTOM COMIC

more than \$10
more than \$3
more than \$2.50
more than \$5
\$3.75
more than \$5
more than \$8
50 cents

SUBTOTAL \$37.75

PLUS

— AN ASSORTMENT OF VALUABLE SEMICONDUCTORS FROM MAJOR SUPPLIERS SUCH AS TEXAS, MOTOROLA, N.S. ETC.

— PASSIVE COMPONENTS FROM OTHER MAJOR SUPPLIERS.

GUARANTEED VALUE OVER \$25
PLUS A LOLLYPOP!!

value over \$60

CELEBRATION SALE!

WE ARE PASSING ON GREAT SAVINGS TO YOU!!

**Cannon XL's
slashed***

Yep, we've chopped the prices on Canon and quality Neutrik connectors. Grab them while they last!

3 PIN LINE PLUG NOW \$2.25
Normally \$3.25 SAVE \$1.00
3 PIN LINE SOCKET NOW \$2.50
Normally \$3.50 SAVE \$1.00
3 PIN CHASSIS PLUG NOW \$1.95
Normally \$3.25 SAVE \$1.30
3 PIN CHASSIS SOCKET NOW \$2.95
Normally \$4.00 SAVE \$1.05
240V MAINS LINE PLUG NOW \$4.95
Normally \$6.50 SAVE \$1.55
240V MAINS CHAS SKT NOW \$3.95
Normally \$5.25 SAVE \$1.30
"NEUTRIK"

3 PIN LINE PLUG (silver finish) NOW \$2.95
Normally \$3.95 SAVE \$1.00
3 PIN LINE SKT (silver finish) NOW \$3.75
Normally \$4.95 SAVE \$1.20
6.5mm PHONE PLUG (silver finish) \$3.50
Normally \$4.50 SAVE \$1.00
3 PIN LINE PLUG (black) NOW \$3.50
Normally \$5.25 SAVE \$1.75
3 PIN LINE SKT (black) NOW \$3.95
Normally \$6.65 SAVE \$2.70
SAVE OVER 40% ON SOME ITEMS

FREE! FREE! FREE! FREE! FREE!

★OVER \$1,000 GIVEAWAY

We will give you — absolutely FREE — a copy of "Hobby Electronics" Magazine just by calling in to Jaycar during April! You don't have to buy anything and you will get a \$1.25 magazine for nothing!! Limited to the first 1000 customers.

spring reverb special

We have purchased a small quantity of high quality US-made spring reverb units. This 3-spring model is the one used in such amps as 'PEAVEY' etc. Grab a spare now or build a complete reverb system with free circuit supplied.

\$34.50

**SOLDER WICK — Swiss made
QUALITY**

ROCK-BOTTOM PRICE!!

You could pay \$1.95 for a Taiwanese version of this 3mm wide x 1.7m long.

SAVE 30c ONLY \$1.65

**FLASHING
LEDs**

**from
*45c**

You don't have to buy
2 from us!
1-9 49c each

over
35% off

**SPECIAL
16 PIN IC
SOCKET**
normally
40c
25 cents

16 pin I.C. sockets — quality
"CAMBION" BRAND
NORMALLY 0.40c EACH

CQY89A slashed

We have got too much stock! As used in many Infra-red remote control projects. Versatile I.R. Light Emitting Diode

**WAS \$1.25
NOW 75c
SAVE 50c**

FABULOUS "MOTOROLA"

Hi-Power Piezo Horn Tweeters. The almost universal choice in high power P.A. or HI-FI applications today

**KSN 1005A 50WRMS 4KHz-40KHz
ONLY \$15.00**
**KSN 1025A 100WRMS 2.4KHz-25KHz
ONLY \$24.00**



KEYBOARD BARGAINS

We are now direct importing keyboards from a major Italian manufacturer. Because there is now no middleman, we can pass on great savings!

SIZE	DESCRIPTION	PREVIOUS PRICE	NEW	SAVE
49 note	C-C Wedge Front Keys	\$117.00	\$85.00	\$52.00
61 note	C-C Wedge Front Keys	\$146.00	\$95.00	\$51.00
73 note	F-F Square (Piano) Front Keys	\$169.50	\$125.00	\$44.50
88 note	A-F Square (Piano) Front Keys	\$190.00	\$175.00	\$15.00

SAVE UP TO 35%!!!!!!

We also carry a wide range of keyboard contacts etc. for any electronic music applications.

510 STRAND TEST LEAD WIRE (RED & BLACK) CAN CARRY UP TO 10A.
85 cents metre — 10 metres or more 75 cents metre — (not in pre-cut packs).

EXPERIMENTER BREADBOARDS

We stock a great range of experimenter breadboards.

WB-TH — total 200 holes	\$8.95
WB-2N — total 840 holes	\$12.95
WB-4N — total 1680 holes	\$24.50
WB-6N — total 2420 holes	\$39.50



enamelled wire bargain

Handy 100 gram rolls of the most common 0.4mm size (that's 26 B&S or 27 AWG).

Normally 100 grams would cost you \$4.95

This month only \$2.95 per roll
SAVE \$2.00 a roll!!!

**SAVE \$2.00
ONLY \$2.95 roll
SOLDERABLE!!!**



el-cheapo CRYSTALS

We have permanently reduced the price of our crystals.

FREQUENCY	HOLDER	OLD	NEW	COMMENTS
1.000MHz	HC-33	\$16.50	\$12.50	6800, 6500 uP
1.8432MHz	HC-33	\$12.50	\$9.50	Baudrate generator
2.000MHz	HC-33	\$8.50	\$7.50	6800, 6500 uP
3.000MHz	HC-18	\$8.50	\$7.50	8021 thru 8048
4.000MHz	HC-18	\$7.50	\$6.50	6802, 6808 etc.
4.433619MHz	HC-18	\$7.50	\$6.50	PAL TV subcarrier
4.9152MHz	HC-18	\$7.50	\$6.50	Standard clock
5.000MHz	HC-18	\$6.50	\$5.50	1802,3,TMS9985,40
8.867238MHz	HC-18	\$7.50	\$5.50	PAL TV 2xsubcarrier
10.000MHz	HC-18	\$9.50	\$9.50	Parallel res for Freq cntr
12.000MHz	HC-18	\$6.50	\$5.50	8086 etc.
16.000MHz	HC-18	\$6.50	\$5.50	several MPU's
20.000MHz	HC-18	\$8.50	\$7.50	808A, 822Y etc.

ALL crystals have low aging rate, tolerance 0.005% @ 25 degree C



We would like to thank the many thousands of people who visited our "Shocking Location" at 380 Sussex St. We are pleased to advise that we are now in a far more convenient location for you — 125 York St. That's right. The SAME address as Dick Smith — only Dick's in the basement and we are DIRECTLY ABOVE HIM. When you call to see us use the main entrance to the building NOT the D.S. entrance. Our phone number has not changed. It's still 264 6688.

Post and Packing: \$5-\$9.99 (\$1), \$10-\$24.99 (\$2), \$25-\$49.99 (\$3), \$50-\$99.99 (\$4), \$100 up (\$5.50)

circuit file

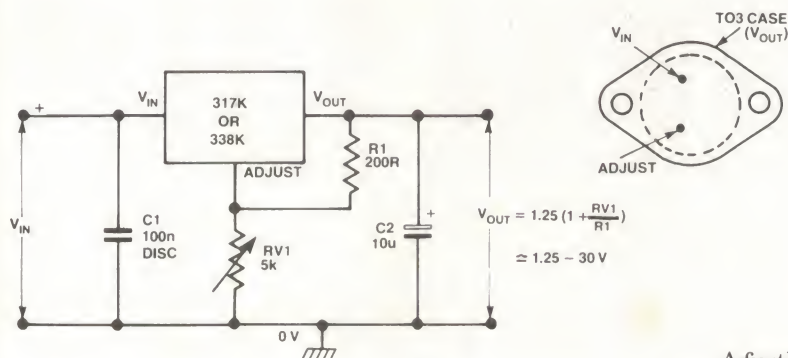


Figure 19. Case outline, basic data and basic application circuit of the 317K and 338K variable-voltage three-terminal regulators.

Figure 19 shows the outline, basic data and the basic variable-regulator circuit that is applicable to these two devices. Both devices have built-in foldback current limiting and thermal protection and are housed in TO3 packages, the major difference between the devices being that the 317K has a 1.5 amp current rating compared to the 5 A rating of the 338K. The major feature of both devices is that their 'output' terminals are always 1.25 volts above their 'adjust' terminals, and their quiescent or adjust-terminal currents are a mere 50 uA or so.

Thus in the Figure 19 circuit, the 1.25 volt difference between the 'adjust' and 'output' terminals causes several mA to flow to ground via RV1, thereby causing a variable 'adjust' voltage to be developed across RV1 and applied to the 'adjust' terminal. In practice, the output of the Figure 19 circuit can be varied over the approximate range 1.25 to 30 volts via RV1, provided that the unregulated input voltage is at least 3 V greater than the maximum output voltage. Naturally, alternative voltage ranges can be obtained by giving R1 and/or RV1 alternative values, but it should be noted that for best stability the R1 current must be at least 3.5 mA.

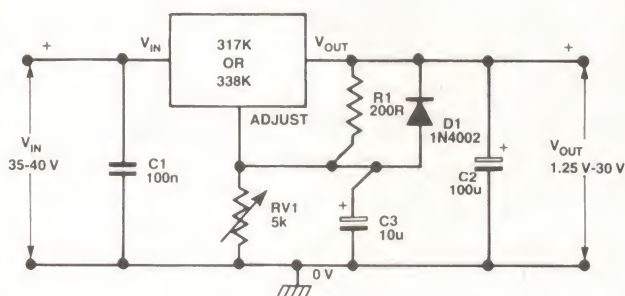


Figure 20. This version of the variable-voltage regulator provides some 80 dB of ripple rejection.

The basic Figure 19 circuit can be usefully modified in a number of ways. The basic ripple rejection factor of the Figure 19 circuit, for example, is about 65 dB, but this can be increased to 80 dB by wiring a 10uF bypass capacitor across RV1, as shown in Figure 20, together with a protection diode connected as indicated, to prevent the capacitor discharging into the IC if the regulator output is short-circuited.

PARAMETER	317K	338K
INPUT VOLTAGE RANGE	4-40 V	4-40 V
OUTPUT VOLTAGE RANGE	1.25-37 V	1.25-32 V
OUTPUT CURRENT RANGE	1.5 A	5 A
LINE REGULATION	0.02%	0.02%
LOAD REGULATION	0.1%	0.1%
RIPPLE REJECTION	65 dB	60 dB

A further modification of the Figure 20 circuit is shown in Figure 21. Here, the transient output impedance of the regulator is reduced by increasing the C2 value to 100uF; diode D2 is used to protect the IC against damage from the stored energy of this capacitor if an input short occurs.

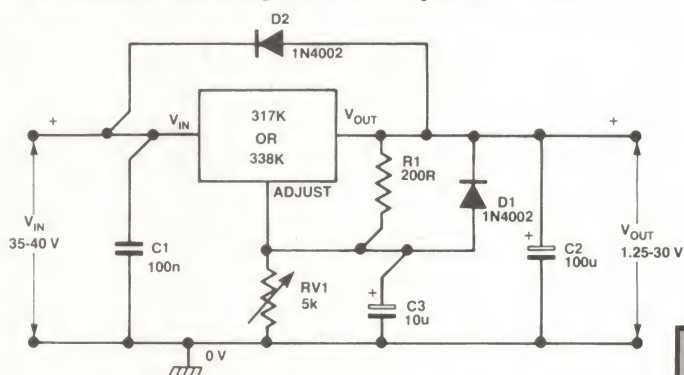


Figure 21. This version has 80 dB ripple rejection, a low impedance transient response and full input and output short circuit protection.

The minimum output voltage of the Figure 19 to 21 circuits is 1.25 volts. If you want the voltage to vary all the way down to zero, the circuits must be configured so that the adjust terminal goes to -1.25 V when RV1 is reduced to zero ohms. Figure 22 shows how this can be achieved, using a 35 V negative rail and a pair of series-connected diodes to clamp the low end of RV1 to -1.25 V.

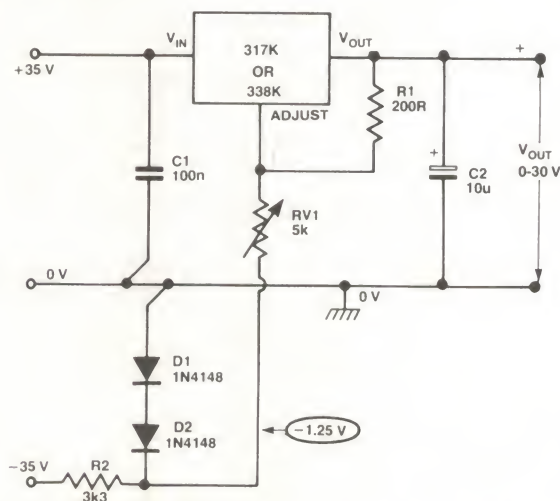


Figure 22. How to provide variable output that goes from 0 V to 30 V.

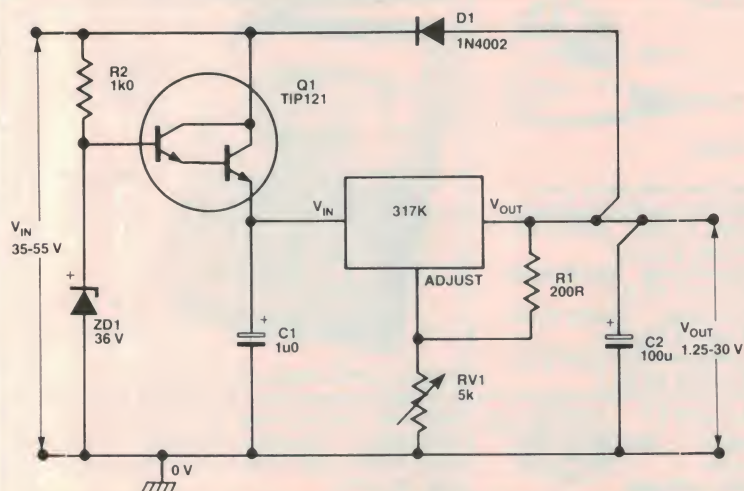


Figure 23. This variable voltage unit uses a pre-regulator (Q1) to give input over-voltage protection and improved ripple rejection.

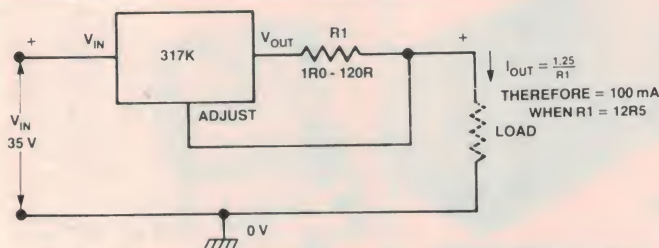


Figure 24. A method of using the 317K as a precision current limiter or constant current generator.

If you want to get the maximum possible voltage out of one of these regulators, you'll need to make sure that the input voltage does not exceed the 40 V rating of the IC. The best way to do this is to use a simple Darlington-plus-zener pre-regulator circuit, as shown in Figure 23, which enables you to use any unregulated input in the range 35 to 55 volts. Note that as well as giving input over-voltage protection, this pre-regulator also gives a further improvement in ripple rejection. If you want to use this circuit with a 5 A 338K regulator, you may need to reduce the value of R1 and beef up the power rating of the zener diode.

Finally, to complete this look at regulator circuits, Figure 24 shows how you can use the 317K as a precision current limiter or constant current generator in which the output current is determined by R1 and is virtually independent of the external load values. By suitable choice of R1, the constant-current magnitude can be set at any value between approximately 10 mA ($R1 = 120\Omega$) and 1.25 A ($R1 = 1\Omega$). Not bad for a two-component circuit!



SOLDERLESS BREADBOARD

NEW RELEASE BY EMONA! NEW RELEASE

MODEL AT-2N



MODEL AT-6N



- Breadboard elements accept all DIP size, including RTL, DTL, TTL and CMOS devices.
- Interconnect with any solid 20 to 29 AWG (0.3—0.8mm) wire
- Breadboard elements are mounted on ground plane, idea for high-frequency, high speed and low noise circuit.
- Moulded snap lock keys help link all strips together.

MODEL	DESCRIPTION	PRICE EXCL. S/TAX	PRICE INCL. S/TAX
AT-DN	1 Distribution strip tie-point 100	\$ 1.94	\$ 2.28
AT-TN	1 Terminal strip tie-point 640	\$ 7.40	\$ 8.70
AT-2N-1	1 Terminal strip tie-point 640. 1 Distribution strip tie-point 100	\$ 9.45	\$11.10
AT-2N	1 Terminal strip tie-point 640. 2 Distribution strip tie-point 200	\$10.98	\$12.90
AT-2NA	Same as AT-2N, 4 Binding Posts. Mounted on aluminium plate	\$15.66	\$18.40
AT-4N-3	2 Terminal strip tie-point 1280. 1 Distribution strip tie-point 100. 2 Binding Posts. Mounted on aluminium plate	\$19.17	\$22.53
AT-4N-1	2 Terminal strip tie-point 1280. 3 Distribution strip tie-point 300. 3 Binding Posts. Based on aluminium plate	\$23.00	\$27.03
AT-4N	2 Terminal strip tie-point 1280. 4 Distribution strip tie-point 400. 3 Binding Posts. Mounted on aluminium plate	\$24.49	\$28.78
AT-6N	3 Terminal strip tie-point 1920. 5 Distribution strip tie-point 500. 4 Binding Posts. Mounted on aluminium plate	\$34.83	\$40.92

N DENOTES NICKEL — PLATED

POST & PACKAGE: Up to \$20 value \$1 From \$20 — \$50 is \$3 \$50 & up is \$5



SOLE AUSTRALIAN AGENTS

EMONA ENTERPRISES PTY. LTD. CBC Bank Bldg. 661 George Street Haymarket Sydney (02) 212-4815



DIECAST BOX BARGAINS

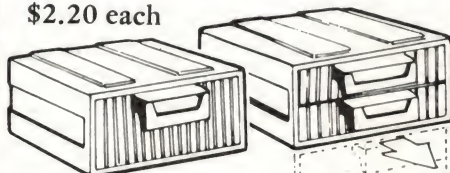


Precision diecast aluminium boxes with slots for sliding in your PCB's. Fully screened to RF when lid is on. Can withstand heat to 600 degrees centigrade!

Cat. H-2201	190(d)x60(h)x110(w)	WAS \$12.90	SAVE \$2.95	NOW \$9.95
Cat. H-2206	150(d)x50(h)x80(w)	WAS \$8.95	SAVE \$1.00	NOW \$7.95
Cat. H-2211	120(d)x40(h)x65(w)	WAS \$5.20	SAVE 25c	NOW \$4.95
Cat. H-2221	100(d)x25(h)x50(w)	WAS \$3.50	SAVE 55c	NOW \$2.95

DRAW UNITS - NOW REDUCED

\$2.20 each



Cat. H-2584 one drawer
Cat. H-2585 two drawers **SAVE 55 cents**

19 INCH RACK MOUNT CABINET



19" quality rack mounting cabinet supplied in a flat pack. Has advanced features and is finished in aluminium.

Silver (Cat. H-2480) and Black (Cat. H-2481)

ZIPPY BOXES

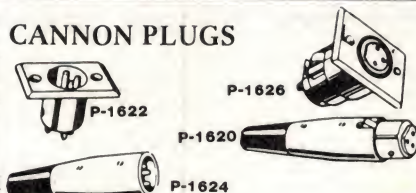


GREAT VALUE

High impact styrene with moulded corner supports and ribs all around for mounting PCB's. Aluminium lid and screws.

Cat. H-2751	150(d)x90(h)x50(w)	\$2.75
Cat. H-2752	196(d)x113(h)x60(w)	\$3.95
Cat. H-2753	130(d)x68(h)x41(w)	\$2.20
Cat. H-2755	83(d)x54(h)x28(w)	\$1.75

CANNON PLUGS



High quality connectors reduced in price! Essential for trouble free audio connections.

Cat. P-1620	3 pin line socket	SAVE 35c
	NOW ONLY	\$3.60
Cat. P-1622	3 pin panel plug	SAVE \$1.80
	NOW ONLY	\$1.95
Cat. P-1624	3 pin line plug	SAVE \$1.50
	NOW ONLY	\$2.25
Cat. P-1626	3 pin panel socket	SAVE 25c
	NOW ONLY	\$3.95

SOLDER SELLOUT!

Corrosion free solder - top quality multicore type.

Cat. N-1619	1.25mm 200 grm	SAVE \$1.00 \$3.95
Cat. N-1623	0.71mm 200 grm	

PLASTIC TOOL BOX BARGAIN ONLY

\$29.50

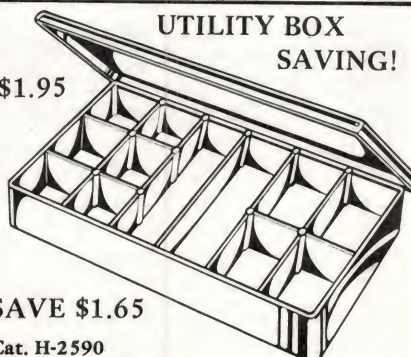
SAVE \$3.00

Polypropylene tool box (427x230x200mm), with two trays & 15 compartments. Ideal for all sorts of uses.

Cat. H-2600

UTILITY BOX SAVING!

\$1.95



SAVE \$1.65

Cat. H-2590

Small, but heavy duty box with compartments for small items. Size: 218(l)x110(w)x33(h)mm.

SENNHEISER MICROPHONES

SAVE \$10

Outstanding value for Hi Fi or movie buffs. Can be used as a cassette mic replacement too!

Cat. C-1021 & Cat. C-1020

OMNI & CARDIOD

\$19.95 each



SOLID STATE BUZZER BARGAIN

99 cents

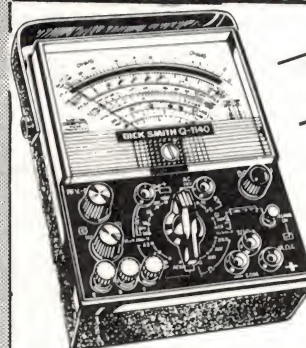
SAVE 96 cents

Solid state buzzer with reverse polarity protection. Tone is at 450Hz with high output. Compact - 32x14.5mm. Use on 4-15V DC.

Cat. L-7009



MULTIMETER REDUCED!!



SAVE \$14.55

ONLY \$59.95

GREAT VALUE

Superb 100k ohms per volt multimeter now reduced in price. Not only does it check the usual DC and AC volts and current but also transistors, capacitors, resistance, decibels etc. Worth lots more than this reduced Cat. Q-1140

HITACHI CRO - FAMOUS QUALITY



\$599.00

This is the top quality Hitachi 15MHz dual trace cro that is ideal for the serious hobbyist. Has extra high sensitivity up to 1mV/div plus 5 display modes plus lots more to make this a much sort after cro.

Cat. Q-1242.

DICK SMITH CRO - REDUCED!!

ONLY \$179

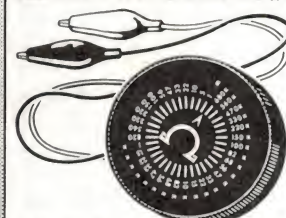
SAVE \$20.00



Dick Smith 6.5MHz lab cro with 75mm green screen. The usable bandwidth is from DC to 6.5MHz +, and is ideal for the lab, workshop or classroom.

Cat. Q-1280

RESISTOR SUBSTITUTION WHEEL



\$7.95

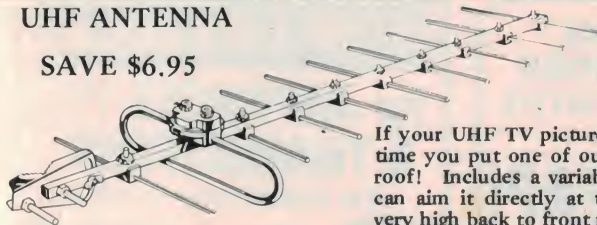
Dial up any resistance value from 5 ohms to 1M ohm in 36 steps. Complete with leads and insulated clips. Cat. Q-1410

MIC. PLUG AND SOCKET

Cat. P-1810 Single plug 90c **SAVE 20c**
Cat. P-1855 Panel skt \$1.20 **SAVE 20c**

UHF ANTENNA

SAVE \$6.95



If your UHF TV picture is not that good it's about time you put one of our superb antennas on your roof! Includes a variable mounting clamp so you can aim it directly at the TV station and it has a very high back to front ratio — essential.
Cat. L-4028

**ONLY
\$15.00**

SUPER SPECIALS — NO PICTURES BUT THE PRICES TELL THE STORY!

SHEET ALUMINIUM

Blank 18 guage aluminium sheet ideal for making your own heatsinks, brackets etc.

Cat. H-2560: 305 x 305mm SAVE \$1 NOW ONLY \$1.95

Cat. H-2558: 152 x 152mm SAVE 55c NOW ONLY 95 cents

TV ANTENNA CLIP

Coloured plastic handles, strong plated spring with screw terminals — connect or disconnect your antenna quickly!

Cat. L-4236 SAVE 20 cents NOW ONLY 30 cents each

NEW NEW NEW NEW NEW — POT NUT AND WASHER PACK

An assortment of useful pot nuts and washers — ideal for the "you'll never know when box".

Cat. H-1360 SUPER LOW PRICE ONLY 95 cents.
240V 2 PIN MINI PLUGS

The ideal plug for experimenters.

Cat. P-1960 SAVE 30 cents NOW ONLY 20 cents each

SERVICE AID SPECIALS!!!!



N-1040 N-1070 N-1051 N-1220 N-1056

MATT BLACK SPRAY PAINT

Quick drying matt black paint — ideal for heatsinks etc.

Cat. N-1070 NOW SAVE \$1.00 \$2.50

SPRAY FREEZER

Instantly freezes components down to minus 50 degrees centigrade. Ideal for finding faulty components etc.

Cat. N-1056 NOW SAVE \$1.25 \$2.25

ELECTROLUBE PRECLENE

High pressure solvent for cleaning switches, relays, pots etc.

Cat. N-1040 NOW SAVE \$0.25 \$5.50

SPRAY CLEANER

Cleaner, degreaser, moisture removing spray. Suitable for tape recorders, computers, watches etc.

Cat. N-1051 NOW SAVE \$1.60 \$2.25

SUPA GLUE

No mess, no mixing, no clamping. Sets in seconds.

Cat. N-1220 NOW SAVE \$0.55 \$1.95

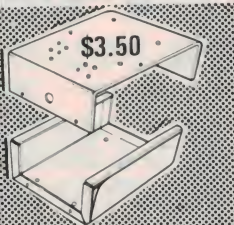
DOORGUARD ALARM BARGAIN



15 touch keys enable you to program your own entry code — if anyone else tries to open the door the alarm will sound. Also a pleasant door chime when not being used in the alarm mode.
Cat. L-5100

SAVE \$10.00
\$19.50

CDI CASE — OVER 50% REDUCTION!

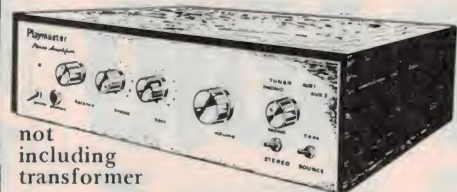


As used in the CDI kit, is ideal for many projects and just look at the price

Cat. H-3107 SAVE \$4.25

**ONLY
\$2.95**

UNIVERSAL AMPLIFIER KIT



not including transformer

Sensational Universal Playmaster amplifier with BI-FET OP AMP input for superlative performance. Depending on the transformer used you can have either 25 watts or 40 watts per channel. Build this kit and get ahead of your friends in power versus quality and price!
Cat. K-3412

SAVE \$4

ONLY \$75

CORE BALANCE RELAY KIT

A kit that will protect you and your family and your equipment. This kit electronically detects any fault in the earth and a relay will shut down the equipment until the fault is rectified.
Cat. K-3315

\$39.50

SAVE \$12.50

BENCH POWER SUPPLY



\$49.50

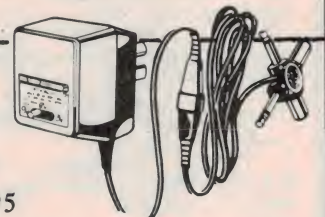
SAVE \$12.50

This bench power supply has a HUGE 4 amp peak and is DC variable between 5 and 15 volts. All connections and controls are easily accessible and there is a large meter to let you know what is happening.
Cat. M-9546

SUPERB POWER PACK

SAVE \$2.80!

ONLY \$6.95



240V AC input and the choice of 3, 6 or 9V DC output. The current rating is 200mA which is more than enough for many applications. 4-way connector to suit most uses and reverse polarity.
Cat. M-9525

CASE FOR PORTABLE CB

Don't leave your CB radio behind, put it in this famous case. Many CB's will fit this case. Cat. D-9010.

\$6.00 SAVE \$19.00!

CENTRE LOADED WHIP ANTENNA

Cat. D-9013 ONLY \$7.95



LIMITED STOCK



TVI FILTER OVER 50% OFF!

Your TVI problems could be solved with this filter. Insertion loss 0.3dB at 30MHz. Great value. Cat. D-7082
PREVIOUSLY SELLING FOR \$10.50!

DICK SMITH Electronics

Don't miss our 144 page catalogue

FREE in this issue!



SEE OUR OTHER ADS FOR ADDRESS AND SERVICE DETAILS

DSE/A211

RADIO



TOP BRAND
NAMES AT
BEST PRICES

ATLAS

TX-110 HF All-Band Transmitters
HK\$700 f.o.b. HK

RX-110 HF All-Band Receiver
HK\$900 f.o.b. HK

210X HF Mobile Transceiver 1.8-
21MHz; HK\$2,600 f.o.b. HK

215X HF Mobile Transceiver 3.5-
28MHz; HK\$2,600 f.o.b. HK

MFJ

MFJ 848 Auto-Memory Keyer
HK\$665 f.o.b. HK

YAESU

YO-101 Oscilloscope

HK\$635 f.o.b. HK

YO-301 Oscilloscope

HK\$630 f.o.b. HK

KURANISHI

RW-1002L SWR Meter

HK\$530 f.o.b. HK

DAIWA

CN-710 SWR Meter; HK\$520 f.o.b. HK

FDK

2025 10 Watts 2M Mobile Transceiver

HK\$1,300 f.o.b. HK

AZEN

PCS-2000 10 Watts 2M Mobile Trans-
ceiver; HK\$1,200 f.o.b. HK

J.I.L.

SX-100 Scanning Receiver

HK\$1,200 f.o.b. HK

REGENCY

Digital AIR Band Scanning Receiver

HK\$1,800 f.o.b. HK

YAESU

FT-707 DM Internal VFO for FT-707

HK\$1,300 f.o.b. HK

DAIWA

RX-110 27MHz Pre-Amplifier

HK\$170 f.o.b. HK



COMMUNICATION
SERVICES LTD

1109 Houston Centre,
Ching Yee Rd.,
Tsimshatsui East,
Kowloon, Hong Kong
Telephone: 3-370287/8
Telex: HX 38083 APPLE
Cables: DELTAENG
HONG KONG

AMS

MAIL
ORDER
CENTRE

TAPES CHEAP!

BULK TAPES DISCOUNTED

Maxell

UDXLIIS C90	EPITAXIAL	12 for \$58
UDXLII C90	EPITAXIAL	12 for \$49
UD C90	ULTRA DYNAMIC	12 for \$38
LN C90	LOW NOISE	12 for \$28

TDK

SA-X C90	SUPER AVILYN	10 for \$49
SA C90	DUAL COATING	10 for \$39
AD C90	SUPER AVILYN	10 for \$30
D C90	ACOUSTIC DYNAMIC	10 for \$24

BASF

CRO ₂ C90	CHROMDIOXIDE	10 for \$48
FE C90	FERROCHROME	10 for \$38
LH C90	LOW NOISE	10 for \$25

VIDEO - OPEN REEL - METAL

MAXELL, TDK, BASF, AKAI

— Send for
complete Tape Price Lists — FREE

HI-FI SYSTEMS

AMPLIFIERS, TUNERS, TAPE DECKS,
TURNTABLES, SPEAKERS, HEADPHONES,
RECEIVERS.

Our range includes:

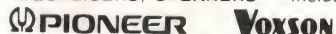


marantz AKAI

SOUND DYNAMICS KSW

CAR SOUND

RECEIVERS, TAPE PLAYERS, BOOSTERS,
EQUALISERS, SPEAKERS — Including:



ACCESSORIES

CARTRIDGES, STYLII, CLEANERS,
DEMAGNETISERS, DISCWASHER



— PARABOLIC STYLUS —
Complete Range



Moving Coil and
Magnetic Cartridges

Ring or Write for Free Price Lists!

TAPE ORDERS:

Add: Pack and Post \$3.00 per Order
and send cheque/money order to:



MAIL ORDER CENTRE

135 HAWTHORN ROAD,
CAULFIELD, VIC. 3162
(03) 528 1149

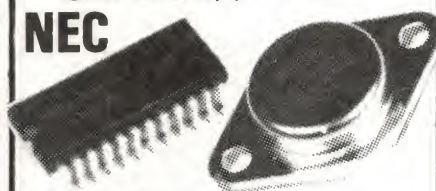
Stock at prices shown available at time
of going to press.

IMARK

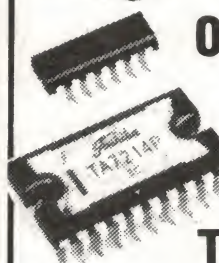
for JAPANESE ICs
& TRANSISTORS

OEM Quantity prices available

NEC



SANKEN



OKI

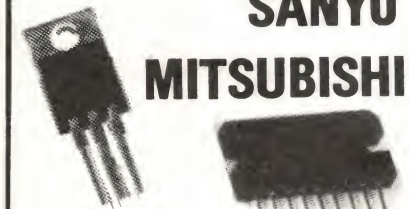
TOSHIBA



HITACHI



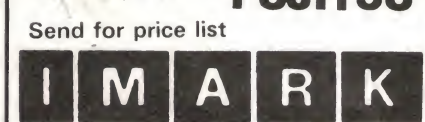
SANYO



MITSUBISHI

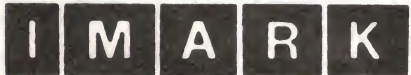


MATSUSHITA



FUJITSU

Send for price list



PTY. LTD.

167 Roden St., West Melbourne,
Victoria 3003

Phone: (03) 329 5433 Telex AA37753

How to get into robotics without boiling your brain cells or breaking the bank

Part 1

Without doubt, every electronics enthusiast has been fascinated with robots and robotics at some time or other. Here's an opportunity to build a robot that starts out as a simple, yet versatile, 'beast' with the capability of considerable expansion. This project is a 'minimum' kit version of the 'Tasman Turtle' robot from Flexible Systems, previously only available in built-up form, developed for publication by co-operation between ETI and Flexible Systems.

Allan Branch

Flexible Systems, Hobart, Tasmania

SOME PEOPLE like to watch turtles in glass tanks, others like to build them; this article is for the latter. Until now anyone wanting to participate in the fine art of robotics has had a number of problems to overcome before the opportunity to actually use a robot becomes a reality.

First of all you had to wait till the second half of the 20th century, when the combination of advanced computing and microelectronics finally brought robots to reality. The concept of an intelligent, moving machine, however, is far from that young; mechanical systems (though not intelligent) in the form of moving statues have been around since as long ago as 1500 BC, and in 1917 Karel Capek invented the title for the new form — he meant it to symbolise work, and the word 'robot' actually comes from the Czech *robota*, meaning forced labour.

The real 'day of creation' for 'intelligent' robots came in 1938, however, when Thomas Ross developed a robot mouse. This first robotic device could attempt and solve mazes, and led the way to descendants which still attempt (though not necessarily solve) mazes in appropriately named 'micro mouse' competitions around the world. After this, development seemed to go off down something of a blind alley, with a rather rigid obsession with microtechniques leading to the evolution simply of smaller and smaller mechanical dolls.

However, by 1968 we were on the right track, and finally saw the evolution of the 'true' robot, able to bump and trip up intelligently, albeit shakily.

These developments didn't solve the robotics enthusiast's second problem, however, which was being able to combine masses of accumulated junk (the usual layman's term for assortments of electronic components and hardware) in order to create a complex *electronism* (analogous to an organism) that actually worked.



Project 645

This proved a much harder step for most people than being born at the right time.

Consequently, most people interested in the concept but unable to put it into practice turned to the closely allied area of computing. They learnt to program computers in BASIC or machine code, to play mazes on monitors instead of with robots, and to come close to real robots only in screen simulations. It was a bit of a let-down, but we kept on expanding our make-believe (paper robots?) world with such gadgets as printers or disk drives in the hope of satisfaction.

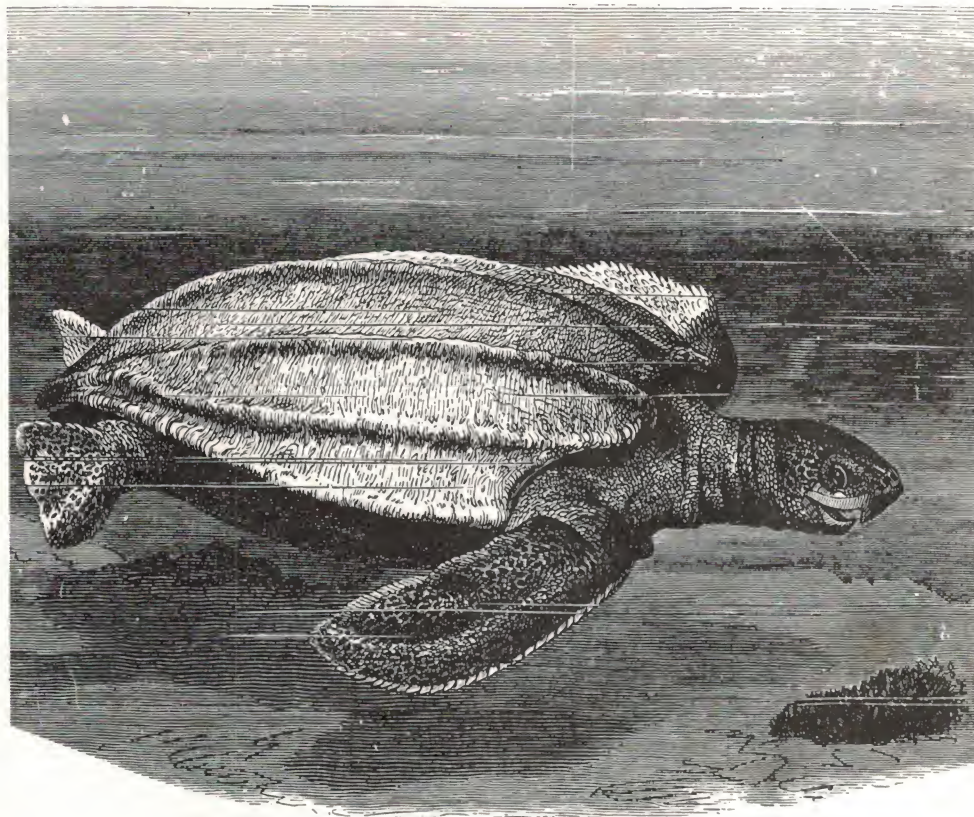
Now, finally, robotics can become a reality. Someone else has put together the loads of components and hardware for us, and, just like the icing on the cake, has designed it to work from our computer and in the languages we have already learnt to use. Voila! The age of the Turtle is with us.

The evolutionary progress from semi-bright mice to intelligent turtles is quite a step, and who knows what will come next. In the meantime, though, what do you do with it?

What is a Turtle, then?

The Tasman Turtle robot, when programmed accordingly, can be used for an almost unlimited range of projects and experiments. Even interaction with its environment is possible with its sense of 'touch', which feeds information back to the computer. A cable or remote control (radio, infrared or whatever) is used to connect the turtle to the computer, with the effect that the robot has the 'brains' of a large or small computer, but the compactness of a mobile base. If you were to try to put the computer on board your robot, it would have to have some pretty hefty motors in it and would have considerable current drain. Just think of the size of your 5 V power supply; the robot would have to have that too!

The Turtle is therefore a very versatile method of implementing a robot base without the problems of large batteries and large motors. As well as being able to 'feel' its way around (provided that's what you program it to do) the Turtle has a number of other functions. Two high-quality stepper motors are used for moving the base. These are geared to give approximately one millimetre of linear displacement per stepper motor pulse. To actually be able to position the robot to within a millimetre of where you want it is incredibly accurate, but this is possible with the Tasman Turtle. Each motor can be turned clockwise, anticlockwise or stopped, both independently, and their



speed can be altered (again independently if need be). As a spin-off, you are going to know a fair bit about stepper motors, and how to control them, by the time the robot is completed.

Also standard with the Turtle robot are a two-tone horn, a pair of beautiful green eyes and an automatic pen holder. The Turtle circuit board has an auxiliary driver channel, allowing you to run additional custom-designed equipment. This means that without having to worry about further electronics or extra control lines from the computer, you can connect your own relay or solenoid, or whatever, from the start. The auxiliary driver utilises the same line as the horn 'high' tone, so if you decide to add your own equipment, the horn becomes single-tone.

All sorts of communication can be carried out using the Turtle's horn or its eyes. The eyes, for example, can be programmed to flash once for yes or twice for no. You could devise a code so that when your program needs information (suppose your turtle is trapped in a maze and wants to know which way to turn to get out) then different numbers of flashes mean different codes. (In the case of the maze you could respond by touching one of the switches and having

the turtle move in that direction).

Similarly the horn can be used for communication since it can be pulse-coded (high = on, low = off). Why not try learning Morse code by having the Turtle talk to you in Morse code with its horn? Different sound effects are possible by varying the tone and the timing of the horn control.

The last thing the Turtle has is its automatic pen mechanism, designed to hold any normal thin pen, pencil or felt pen, which can be controlled (up or down) from the computer. The Turtle becomes a ready-made graphics device with the 'pen in toe' and, combined with the accuracy mentioned previously, the computer art capabilities are enormous. Some ideas worth mentioning are to get the Turtle to spell your (or its!) name — try it in script writing. Get it to print questions or statements on paper instead of on the screen. It could leave a path when it follows a maze to give a permanent trace of its movements. What about using it as an xy plotter? Quite complex patterns or designs are simple to generate using the pen facility. I have even had the Turtle 'rattle its brains' by vibrating the solenoid for a startling effect (without the pen in its holder!).

NOTE: 'Tasman Turtle' is a registered trademark of Flexible Systems.

The next thing to learn is how to actually make the Turtle do all these things. Firstly, though, it is important to contemplate a few aspects of the robot so that you can enjoy all its benefits.

This Tasman Turtle is probably the first robot for hobbyists designed to be run from a microcomputer, and as such is perhaps much more powerful than anything seen before. It is certainly more versatile. The programming (as will be explained) is extremely easy, so much so that even a complete novice will be able to run the Turtle around long before screen graphics are mastered. The sample programs to be given are in BASIC, but the Turtle can run in any language, even machine code, and a very special language called LOGO has been developed so that the Turtle can be programmed by typing in words like 'forward, back, left, right, pen up, toot 10', etc.

A big feature of the Tasman Turtle is its versatility. Because it is not restricted to ROMs (and therefore to people who can handle ROMs) there is no special equipment or requirements needed to get started. You can make the Turtle do simple things to begin with and then progress as you become better at programming or as you become more familiar with the robot. It is possible to do quite advanced experiments with the Turtle which require no actual changes to the robot. It is all possible because the robot takes on the identity of *your* program. It can be an art robot; be used to devise heuristic programs, study learning techniques, simulate conditioning; it can study the shape of a room and build a memory map or identify objects, detect objects that have changed position, work out the area and perimeter of



the room; it could take on promotional work, have fun in shop windows, advertising; demonstrate information theory, process control and many other things I haven't even thought of. Most of all, though, it is *fun* robotics.

While the Tasman Turtle is multi-variate by virtue of programmability, it is also a suitable standard base for anyone interested in further electronic additions. Most of us have some ideas of what we would have in a robot if we built one, and the Turtle robot becomes a platform for just that.

A wide range of simple and effective projects can be implemented with the Turtle, from line following to speech, and some will be presented in this short series of articles. Many projects meant for other uses will also adapt easily to the Turtle (anemometer, light sensor, load detector, sound operated switch, for example), and I can just see little claws 'snapping' away at anything that crawls! Imagine — a moving, talking, hooting-tooting, snapping Turtle!

Enough day-dreaming, shall we get on with the reality?

PARTS LIST ETI-645

MINIMUM TURTLE — HARDWARE

- | | |
|---|---|
| 1 x bakelite base, 330 mm dia., cut and drilled | 1 x 100R, 1 W resistor |
| 2 x front motor mounts (triangular) | 1 x 1 m length rainbow cable |
| 2 x rear motor mounts (elbows) | 1 x length of speaker wire |
| 2 x wheel axle brackets (small elbows) | 1 x 25-pin connector (RS232 type) |
| 2 x stepper motors | 2 x hex keys (for gear grub screws) |
| 2 x small brass gears, 12 mm dia. | 4 x 1" x 1/8" Whitworth steel screws |
| 2 x nylon gears, 40 mm dia. | 4 x 3/4" x 1/8" Whitworth steel screws |
| 2 x axles (5 x 45 mm) | 13 x 1/4" x 1/8" Whitworth steel screws |
| 2 x rubber tyred wheels | 2 x 1/2" x 1/8" Whitworth steel screws |
| 4 x microswitches | 2 x 3/8" x 1/8" Whitworth steel screws |
| 1 x wooden front foot (hemispherical, drilled) | 24 x 1/8" Whitworth steel nuts |
| 1 x smoke-tinted plastic dome | 43 x metal washers |
| 1 x circular 'touch' band | 1 x metal self-tapping screw |
| 1 x clear plastic disc, 230 mm dia., drilled | 4 x 1/2" (12.5 mm) long x 1/8" tapped Whitworth metal spacers |
| 1 x small speaker | 2 x 1/2" (12.5 mm) long tubular spacers |
| 1 x solenoid | 2 x 2" (50 mm) long tubular spacers |
| 1 x pen bracket & clamp assembly | 2 x 2 1/2" (63.5 mm) long tubular spacers |
| 4 x red LEDs and bezels | 4 x 3" long x 1/8" Whitworth steel screws |
| 2 x green bezel lamps | |

Construction

There are four individual sub-assemblies involved in the 'minimum' Turtle. These are: the base, the small inner disc, the electronic control pc board and the dome. Everything mounts to the base, one way or another. Putting the beast together is simpler than describing it — of that, we can assure you! In this part we will cover the assembly of motor drive and 'touch' systems to the base plus the assembly of the various components that mount on the small inner disc. In the next part (May issue) we will cover the assembly of the electronics and completing the Turtle, plus a power supply and rudimentary controller. Let's go, then!

First step is to sort out and identify all your hardware. A hardware parts list is included here for your guidance. Note that, where possible, measurements have been given in metric and imperial. Generally, Whitworth thread nuts and bolts are employed. You will need some 'five minute' epoxy glue, or similar.

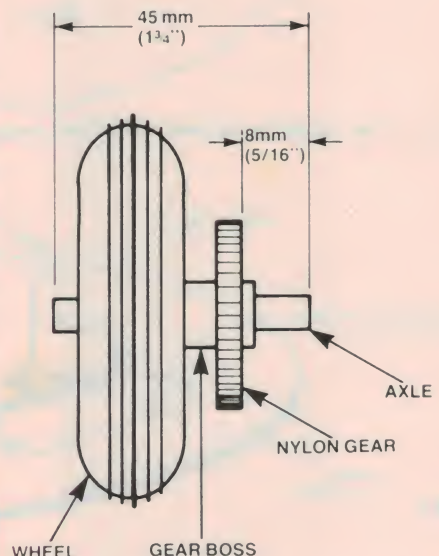


Figure 1. Wheel assembly. Wheel hub butts against gear boss and the two are glued at this point.

Wheels

Figure 1 shows the wheel assembly when completed. Place a nylon gear on each axle such that the face opposite the boss is exactly 5/16" (8 mm) from one end. Tighten the grub screw using the appropriate hex key supplied (the larger of the two). Now push a rubber tyred wheel on each axle — you'll find it a firm fit, so that the wheel and gear boss touch. Glue the wheel to the gear boss using epoxy glue or similar. ▶

Project 645

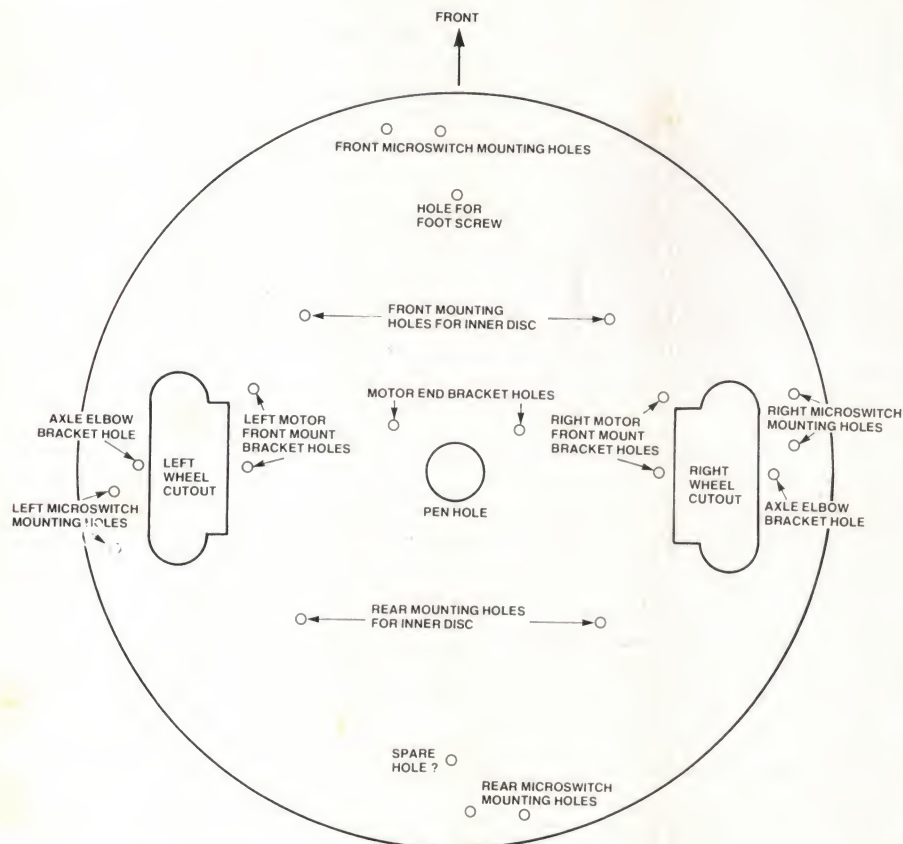


Figure 2. The Turtle base and how to identify the various holes.

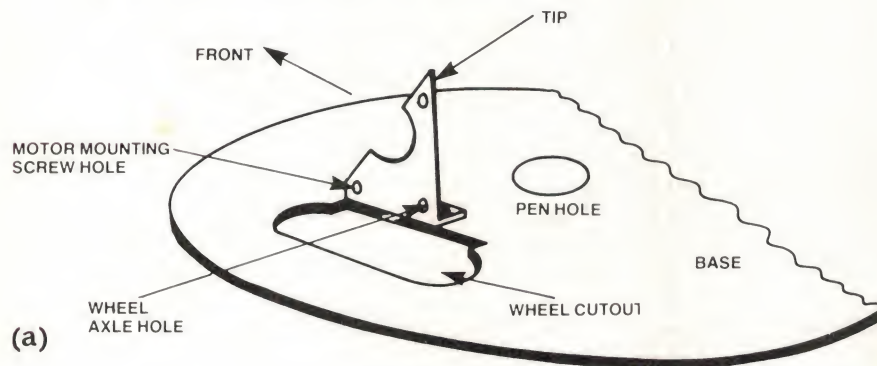
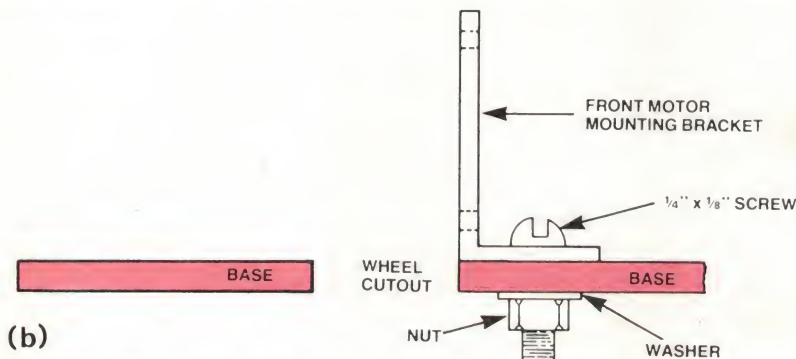


Figure 3. (a) Mounting the left hand front motor bracket to the base. (b) Position the bracket such that the edge is flush, or as near as possible, with the edge of the wheel cutout. The right hand bracket mounts in a similar way.



Motor and wheel assembly mounting brackets. From left to right: rear motor elbow bracket, small elbow wheel axle bracket and the front motor mounting bracket. You'll have a pair of each.

Base

Take the bakelite base and identify the top — you should find a 'Made in Tasmania' sticker on the top side. If not, turn it so that the holes correspond with Figure 2. Identify the two front motor mount brackets.

Now find out which is for the left hand motor and which is for the right. Taking the left hand bracket, mount it as shown in Figure 3a. Ensure that the bracket is flush with the edge of the wheel cutout (or nearly so), as in Figure 3b. The right hand bracket is mounted in a similar fashion.

Now you can mount the wheels. Locate the wheel axle hole in the left hand motor bracket — see Figure 3a. Take one wheel assembly. The nylon gear goes toward the motor mount bracket. Slip that end of the axle in the appropriate hole in the bracket (Figure 4a), slip a small elbow wheel axle bracket on the other end of the axle and secure it as shown in Figure 4b. Note that the slotted hole in the small elbow wheel axle bracket is on the base and the bolt passes through it. Now mount the other wheel in a similar fashion.

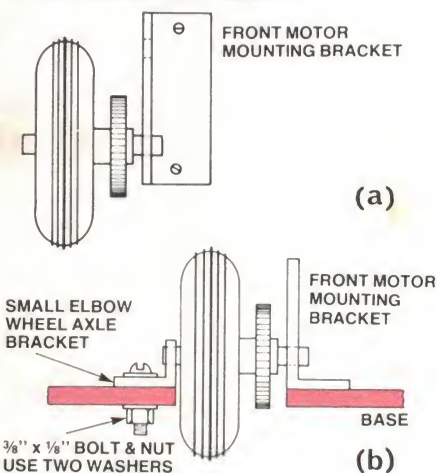


Figure 4. Mounting the wheel assembly to the left hand front motor bracket. (a) Insert the nylon gear end of the axle in the appropriate hole in the front motor bracket (view looking down). (b) Support the other end of the axle with the small axle elbow bracket and temporarily bolt it in place. The right hand wheel assembly mounts in a similar way.

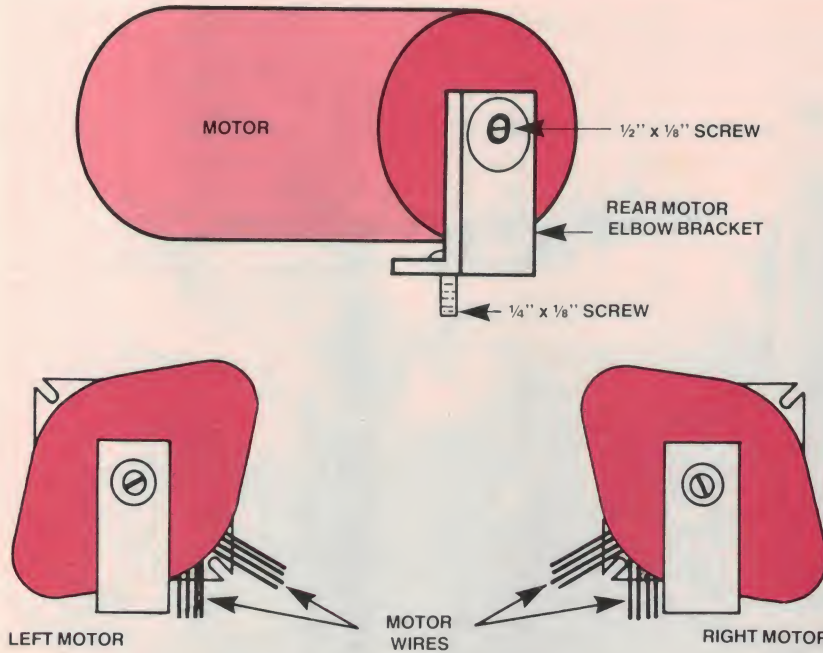


Figure 5. How the rear motor mount bracket is fixed to each motor. Note the different positions for the left and right motors.

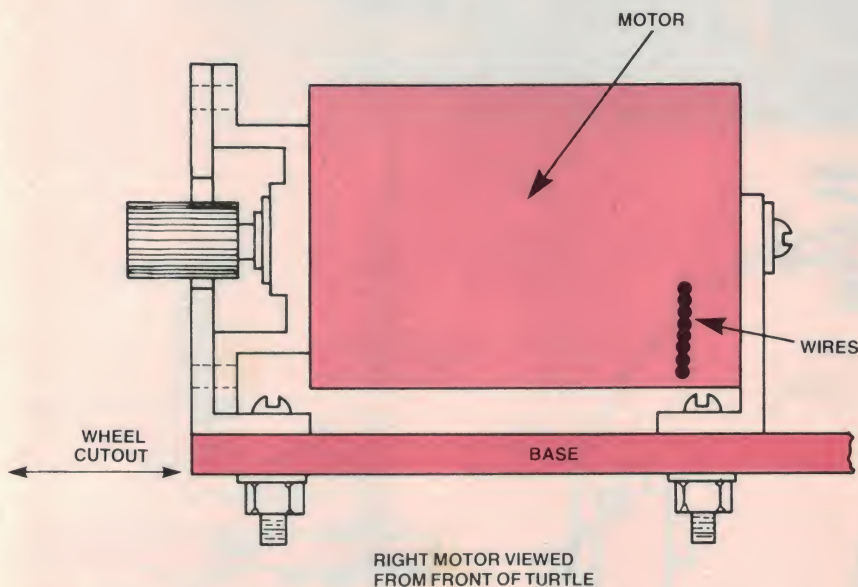


Figure 6. Mounting the motor. Secure the end bracket screw first.

The front 'foot' comes next. This is a small hemisphere of wood with a hole drilled in the bottom. Locate the mounting hole for it — see Figure 2 — and secure it to the underside of the base with the self tapping screw provided. Take care not to tighten it too much or your might split it.

Motors

Take the two stepper motors and the two small (12 mm dia.) brass gears. These should be placed on each motor shaft so that the grub screw is furthest from the motor. Mount each gear flush



The wooden front 'foot' and its mounting screw.

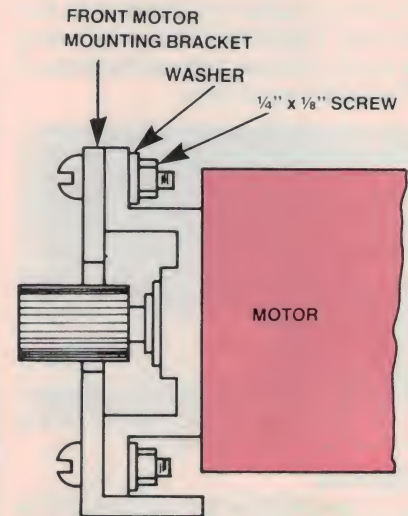


Figure 7. Securing the front face of the motor to the mounting bracket.

with the end of the motor shaft and tighten the grub screws with the hex key provided. (These require the smaller hex key). Now take the rear motor elbow brackets. Place a $\frac{1}{8}$ " x $\frac{1}{4}$ " screw in the hole in the small end of the bracket — this is used to secure the end of the motor to the base. Remove the existing end screws in each motor. Secure each bracket to the motor, as per Figure 5, with a $\frac{1}{2}$ " x $\frac{1}{8}$ " screw. Use a washer under each screw head. Note that these brackets are mounted differently on each motor. The motor that will drive the left hand wheel has the wires passing to the right at the bottom of the rear bracket, while the right hand wheel motor has the wires passing to the left of the rear bracket, at the bottom. This means that, when the motors are mounted to the base, the wires pass towards the front of the Turtle.

Take one motor and place the screw hanging from the end bracket through the appropriate hole in the base (see Figure 2), so that the shaft end of the motor butts against the front mounting bracket as per Figure 6. Loosely secure the end bracket with a nut and washer. The brass gear will mesh with the nylon gear and set the wheel assembly in position. Now you can tighten the screw holding the wheel axle elbow, after positioning the elbow so that it is flush with the wheel hub.

The front face of the motor can now be attached to the mounting bracket using $\frac{1}{4}$ " x $\frac{1}{8}$ " screws. A single washer is placed behind the motor face, as shown in Figure 7. Adjust the meshing of the gears by slightly moving the motor so that the gears mesh well without bending. Finally, tighten all the mounting nuts.

Project 645

The other motor is mounted in the same way. Check that the motor wires pass along the base toward the front of the Turtle for each motor.



Top: the microswitches used. Bottom: the pen bracket and pen clamp assembly.

Switches

Four microswitches are employed for 'touch' or 'bump' sensors. These are located at 90° intervals around the perimeter of the base. Figure 8a shows their location and orientation. Note that they mount on the top side of the base and the actuators point *clockwise* around the base. Each microswitch is secured by one $\frac{3}{4}$ " x $\frac{1}{8}$ " screw and one 1" x $\frac{1}{8}$ " screw. The shorter screw passes down through the switch while the longer passes up through the base, as shown in Figure 8b, the latter also being used to secure the dome.

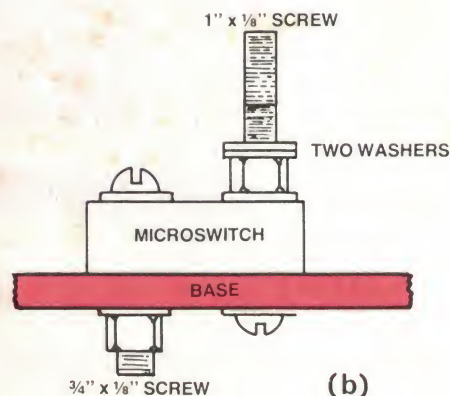
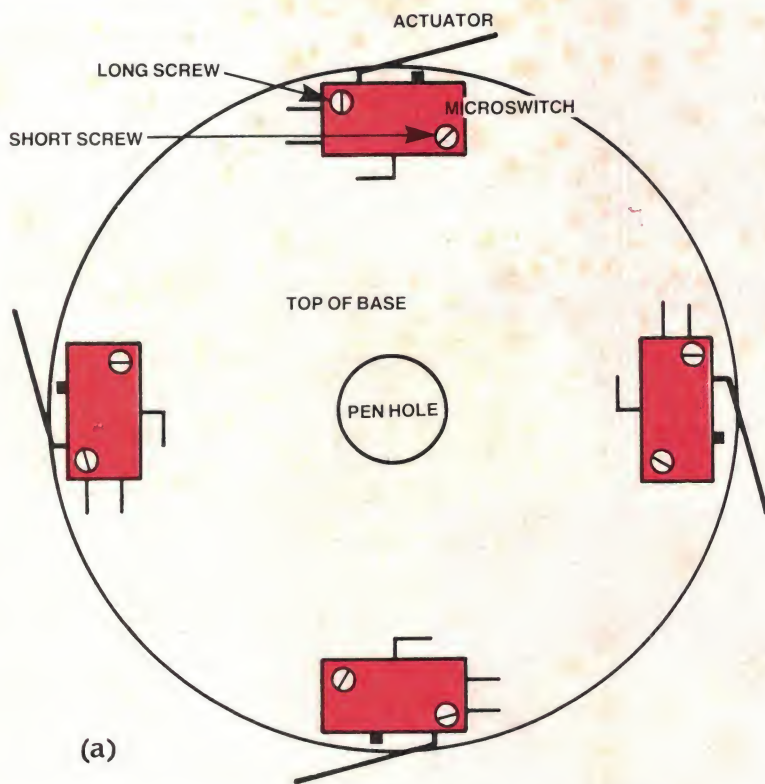
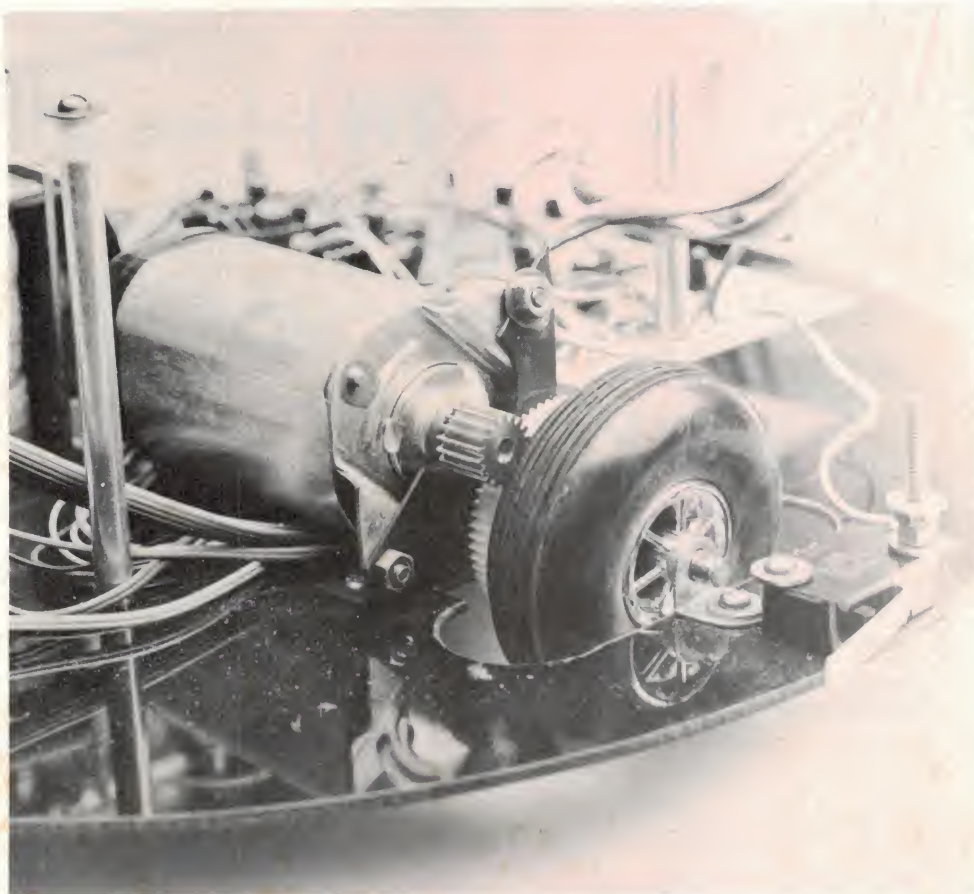
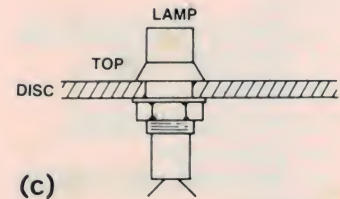
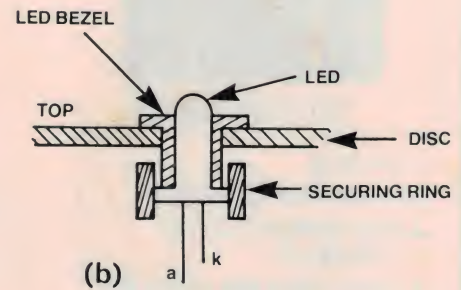
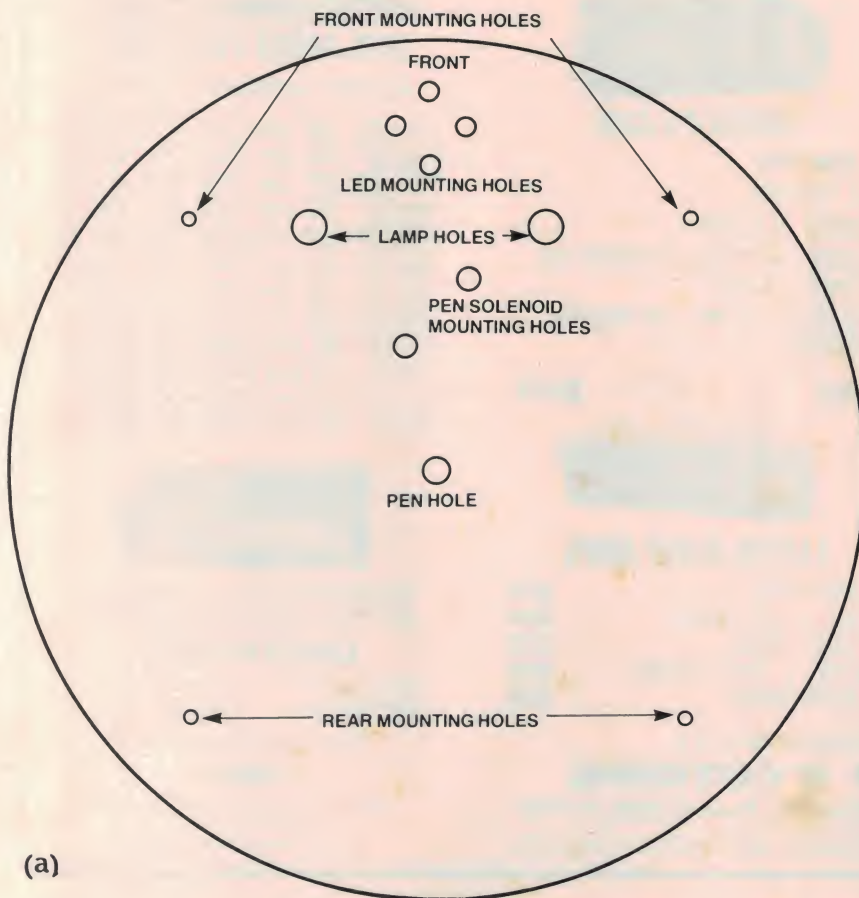


Figure 8. Locating and mounting the microswitches for the 'touch' or 'bump' sensor ring. (a) Orient the actuators clockwise around the base. (b) The 1" long screw is passed up from under the base through the outermost mounting hole. The $\frac{3}{4}$ " screw passes downwards through the innermost hole. Use washers under each screw head and nut.

Inner disc

The clear plastic 230 mm diameter disc is used to mount four LEDs, two lamps and the pen solenoid. Take the disc and orient it as per Figure 9a. Note which holes are used to mount particular components. We can start with the four LEDs. You should have four bezels for them; insert them in the holes and push



Speaker

Solder the 100 ohm, 1 W resistor to one of the terminals on the speaker after cutting each of the resistor leads to about 12 mm long

(... to be continued)

Figure 9. The inner plastic disc. (a) How to identify the various holes. (b) How to mount the LEDs and lamps.

a LED into each one from beneath. They should snap in. Then push the securing ring over the bezel from beneath (see Figure 9b). Cut the LED leads so that they're about 12 mm ($\frac{1}{2}$ ") long — keep the longer (anode) leads slightly longer for later identification.

Now mount the two green bezel lamps. The bezels go on the top of the disc. These lamps are secured with a large hex nut and a spring washer on the bottom side of the disc.

Pen solenoid

The pen solenoid mounts on the underside of the inner disc, in the way shown in Figure 10. Note that a washer is placed between the solenoid base and the disc for each of the two mounting screws ($\frac{1}{4}$ " x $\frac{1}{8}$ "). Make sure you orient it correctly as the speaker mounts on the solenoid frame later and it must face the front of the Turtle.

See that the plunger of the solenoid has its keyway toward the front. The pen holder bracket and arm are already assembled and you can screw this assembly onto the solenoid plunger now. The pen solenoid is tightened later on after the pen centring is adjusted.

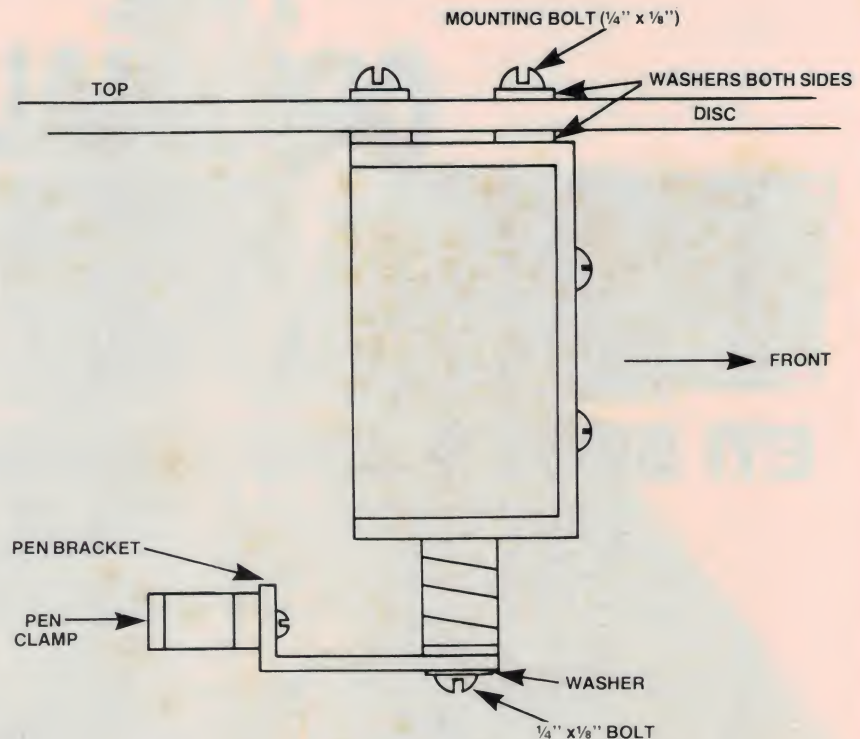


Figure 10. Mounting the pen solenoid.

Complete Disco System



for only \$2950

including

- LENTIK PDM 1000 MIXER
- TWO TECHNICS SLB 202 TURNTABLES
- LENTIK 150W RMS POWER AMP
- TWO LENTIK 112 HT 3 WAY ENCLOSURES (rated at 150W RMS EA.)
- MICROPHONE HEADPHONES AND ALL NECESSARY LEADS
- MUSICOLOR IV
- FOUR PAR 38 LIGHT BOXES (four globes in box)
- ONE YEAR PARTS AND LABOUR WARRANTY



LENTIK PA 4200

- 150W RMS
- 4 CHANNEL
- BUILT IN REVERB
- BASS AND TREBLE CONTROL ON EACH CHANNEL
- MASTER VOLUME AND MASTER REVERB

\$565

Without carpeted box

\$515



LENTIK SLAVE AMPS

- 75W MONO \$299
- 75 + 75 STEREO \$390
- 150W MONO \$350
- 150 + 150W STEREO \$495
- 350W MONO \$450

MANUFACTURED IN QUEENSLAND BY:

UNITED SOUND SYSTEMS

Corner Ann and Warner Streets, Fortitude Valley 4006. Phone 52 2899, 52 7538
SERVING QUEENSLAND AND NORTHERN NEW SOUTH WALES

UNITED SOUND SYSTEMS QLD. AGENT FOR ETONE

Models available ex stock

611	12"	300 mm	30W RMS	\$34.90
616	12"	300 mm	Twin Cone	\$42.60
511	12"	300 mm	40W RMS	\$45.10
516	12"	300 mm	Twin Cone	\$60.20
231	12"	300 mm	60W RMS	\$66.20
236	12"	300 mm	Twin Cone	\$79.20
241	12"	300 mm	80W RMS	\$82.95
246	12"	300 mm	Twin Cone	\$88.20
451	12"	380 mm	100W RMS	\$140.50
484	12"	380 mm	200W RMS	\$220.40
801	15"	380 mm	200W RMS	\$242.20
805	15"	380 mm	250W RMS	\$247.30



BACKGROUND MUSIC TOO EXPENSIVE
NOT WITH A LENTIK AM/FM AUTO REV

CASSETTE RADIO

- AM/FM Radio
- Auto Reverse
- Cassette Deck
- Built in 20 watt Amplifier
- line out socket

Only requires speakers

\$399

All prices include freight to Qld. Coastal Cities.

Trade inquiries welcomed.

THE ORIGINAL



ETI SERIES 5000 HEATSINK PANEL

Designed by David Tilbrook to suit the Series 5000 MOSFET stereo amp., and manufactured for ETI these cast aluminium heatsinks have a good finish, are drilled and tapped to take the mounting bracket which holds two ETI-477 100W MOSFET modules and are finished in a tough matt black paint. If you are unable to obtain one from your local supplier, you can obtain one direct from ETI or by mail order.

Please add \$1.50 post & handling, within Australia, \$3 to New Zealand and New Guinea.

Send your cheque or money order to cover the number you require to:

SERIES 5000 HEATSINK/FRONT PANEL

ETI Magazine, 15 Boundary St, Rushcutters Bay, NSW 2011. Please allow up to four weeks for delivery.

READERS SPECIAL!

A limited number of these Heat-sinks are being offered to E.T.I. readers at the special price of

\$20 (approx 40 left)

Order yours now at this low price, while stocks last.

TASMAN TURTLE ROBOT KIT

**SPECIAL
OFFER**

EXCLUSIVE TO ETI READERS

Special Offer Price:

\$349.00

(tax exempt: \$297.00)

plus \$6 post and handling

(inc. registration).

This product has never previously been offered as a kit and would normally retail for around \$600



*Tasman Turtle is a registered trademark of Flexible Systems.

OFFER CLOSES 30 JULY 1982

Here is a not-to-be-missed opportunity to get started in robotics. For minimum cost this kit will provide you with the basic equipment to construct a robot which can be driven by remote control, electronic hand control or under computer control. Called the 'Minimum Turtle Kit', it has been put together by Flexible Systems of Hobart, Tasmania, manufacturers of the Tasman Turtle (see Printout, page 82, February ETI). Using this kit as a start you can develop a sophisticated robot capable of a huge variety of tasks.

The complete Minimum Turtle Kit comes ready for assembly according to the construction description published in ETI, packed in a box which has been designed so that the Turtle may be housed or stored in it after assembly.

HOW TO PURCHASE A MINIMUM TURTLE KIT

Fill out the coupon here and include a cheque or money order for a total of \$355. Make out the cheque or money order to 'Flexible Systems, Turtle Kit Offer', and post it, together with the coupon, to:

ETI/Turtle Robot Kit Offer
ETI Magazine
15 Boundary St
Rushcutters Bay NSW 2011

The orders will be processed by ETI and, on clearance of the cheque or money order by Flexible Systems, the kit will be despatched directly to you by ETI via registered post.

Alternatively: You may call in to ETI's Sydney or Melbourne offices at the addresses given below and purchase a Minimum Turtle Kit for \$349. A demonstration kit and/or model will be available for inspection during this offer.

Sydney: ETI, 4th Floor
15 Boundary St
Rushcutters Bay

Melbourne: Murray Publishers, 22nd Floor
150 Lonsdale St
Melbourne

Tax exemption: For schools, TAFEs, etc. this kit can be purchased at the tax exempt price **only** if the coupon is accompanied by a signed order and a tax exemption declaration.

NOTE: This offer is made by Flexible Systems in co-operation with ETI Magazine. ETI is acting as a clearing and despatch agent for orders. All mail orders will be despatched by registered post. Please allow four to six weeks for delivery.

Note that the offer expires 30 July 1982.

WHAT YOU CAN DO WITH IT

You can use your Minimum Turtle to experiment with many aspects of robotics by interfacing it with a computer: draw figures under program command, solve mazes, make measurements, identify objects, etc. It can be driven via a cable or a remote control. The Minimum Turtle has been designed so that a wide variety of add-on projects may be included to increase the sophistication as you desire.

THE MINIMUM TURTLE KIT CONTAINS:

- All hardware (base, nuts and bolts, perspex dome, 'touch' ring, pen solenoid, speaker, etc)
- All mechanical parts (wheels, gears, axles, two stepper motors, etc)
- 'Standard Turtle' electronic control pc board and components
- All wire and cable for internal wiring
- A 25-pin plug for bidirectional data buss, control lines and power supply connections
- Comprehensive instruction manual

COUPON

Please supply Minimum Turtle Kit(s)

I enclose \$ plus \$6 each postage (inc. registration).

TOTAL \$

Name

Address

. Postcode

Cheque or Money Order No

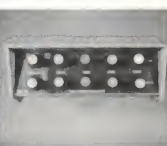
Signature

(please allow four to six weeks for delivery)

425 HIGH STREET, NORTHCOTE 3070. MELBOURNE. (03) 489-8131

ETI-469

Boom-tisha-boing-crash! Synthesise it all with the ETI-469 Percussion Synthesiser. Huge range of sounds can be 'made up'.



Turn your Series 5000 Stereo Power Amp into a monster 300W high performance mono amp!
P.O.A.



Here's an amp module for guitar or P.A. work that delivers the goods — 150W, clean reliable sound, where you want it, when you want it.



SOUND EFFECT UNIT
Climb in your Sopwith Camel and after the Red Baron! Realistic prop aircraft sound with variable speed — from taxi-ing to full climb.
P.O.A.



ET	PCB PRICE	DESCRIPTION	DATE	PRICE	DESCRIPTION	DATE	PRICE	DESCRIPTION	DATE	PRICE	DESCRIPTION	DATE	PRICE	
ET 014	4.50	Dual Voltage Power Supply	Dec 71		ET 547	3.50	Telephone Bell Extension	Jan 77	80LS12	3.50	SELECTALOTT	Dec 81	\$22.00	
ET 043	2.00	Head or Tails	Oct 76	\$2.50	ET 549A	2.90	Metal Detector	May 77	80LBRT2	2.50	Light Beam Relay	Nov 80	\$13.00	
ET 044	1.90	Two Tone Doorbell	Oct 76	\$4.50	ET 560	1.90	240V Mains Locator	May 80	80M4A	2.50		Apr 80		
ET 047	1.90	Morse Practice Set	Dec 76	\$3.00	ET 561	2.90	Metal Detector	Mar 80	\$34.90	80M4C	2.50	Power Heat Controller	Jun 80	
ET 048	1.90	Buzz Board	Dec 76	\$3.00	ET 562	3.90	Geiger Counter	Apr 80	\$54.00	80HSH6	3.50	See How Siren	Jun 80	
ET 061	2.20	Simple Audio Amp	Oct 76	\$2.50	ET 563	3.50	Nicad Fast Charger	Jul 80	80PCT	3.50	Power Saver Induction MTR	Jul 80		
ET 062	2.50	Simple AM Tuner	Mar 77	\$2.50	ET 566A	2.90	Pipe & Cable Locator	Apr 80	80PFB12	2.90	Guitar Fuzz Box	Feb 81	\$19.00	
ET 063	2.50	Electronic Bongos	Nov 79	\$3.00	ET 566B	3.90	Pipe & Cable Locator	Apr 80	80G6	2.90	Musical Tone Generator	Jun 80		
ET 065	2.20	Electronic Siren	Dec 79	\$2.50	ET 567	3.50	Core Balance Relay	Apr 81	\$42.90	80G6S	2.90	Voltage Regulator Multi	Mar 80	
ET 066	1.90	Temp Alarm	Dec 79	\$4.00	ET 568	2.90	Photo Flash Trigger	Oct 80	\$25.00	80AD12	3.00	Autodim Light Dimmer	Dec 80	
ET 068	2.20	Lad Dice	Oct 76	\$2.50	ET 570A	4.90	Infrared 'Trip' Relay TX	Jan 82	80AU3	3.50	Hi Fi Auto Turn Off	Mar 80		
ET 071	2.50	Tape Noise Limiter	Jan 79		ET 570B	4.90	Infrared 'Trip' Relay RX	Jan 82	80AW4	4.50	Receiver All Wave	Apr 80	\$48.50	
ET 072	1.90	Two Octave Organ	Jan 78	\$8.50	ET 572	3.50	Digital PM Timer	Dec 80	80MTBA	5.90	Digital Engine Analyser	Aug 80		
ET 083	2.90	Train Controller	Dec 79		ET 576	3.50	Electronic Program	Oct 79	80TM8B	2.50	Digital Engine Analyser	Aug 80		
ET 084	2.50	Car Alarm	Jan 77	\$12.00	ET 577	3.50	General Purpose Power Supply	TPV 6	\$38.50	80PPTA	6.50	Erom Programmer	Jul 80	\$72.50
ET 085	1.90	Car over Rev Alarm	Oct 79		ET 578	2.90	Simple Nicad Charger	TPV 6	80PPTB	2.50	Erom Programmer	Jul 80		
ET 130	1.90	Temp/Volts Converter	Feb 77		ET 581	2.50	15V Dual Power Supply	Jan 80	80R5	2.90	Rumble Filter	May 80		
ET 132	2.90	Experimenter Power Supply	Aug 77		ET 583	2.90	Marine Gas Alarm	Jan 77	80R5A	2.90	Cylon Voice Simulator	Dec 80	\$19.50	
ET 134	2.90	R.M.S. Voltmeter	Aug 77		ET 585R	1.90	Ultrasonic Receiver	TPV 6	80SA3	4.90	Playmaster Stereo Amp	Mar 80		
ET 135	2.50	Digital Panel Meter	Oct 77		ET 585T	1.90	Ultrasonic Transmitter	TPV 6	\$18.00	80CH7	6.50	240 V.A.C. Light Chaster	Jul 80	
ET 136	2.50	Linear Scale Cap. Meter	Mar 78		ET 585	3.90			80RAM12	3.90	Ram Expansion for Dream	Dec 80	\$8.00	
ET 137A	3.90	Frequency Meter Lcd	May 78		ET 591A	2.50	Up/Down Digit Counter	Jul 78	80PA6	7.50	Playmaster 300W amp. Module	Jun 80	\$83.00	
ET 137B	3.90	Audio Oscillator	May 78		ET 591B	2.50	Up/Down Digit Counter	Jul 78	80CL4	3.50	Trans Controller	Apr 80		
ET 139	1.90	Power Meter	May 78		ET 596	2.90	White Noise Generator	Nov 81	\$8.00	80T8S11	2.90	TRS 80 Print Serial In	Nov 80	\$15.00
ET 147	3.50	Electronic Dummy Load	Oct 80	\$88.00	ET 598	2.50	Touch Switch	Feb 81	\$19.00	81DC2	2.20	Le Gong Doorbell	Feb 80	\$18.00
ET 149	3.50	2 Tone Generator	Jul 80		ET 598B	2.50	Touch Switch	Feb 81	81D75	3.00	Dream Tape Controller	May 81		
ET 152	2.90	Capacitance Meter	Feb 80	\$34.50	ET 599A	2.50	Infra Red Remote Control TX	May 80	81GA3	11.50	Colour Graphic Analyser	Mar 81	\$88.00	
ET 157	4.50	Crystal Marker	Oct 81	\$29.50	ET 599B	2.90	Infra Red Remote Control	May 80	81UC8	4.50	Universal Timer and Stopwch.	Aug 81		
ET 158	3.50	Low Ohms Meter	Nov 81	\$29.50	ET 599C	2.50	Infra Red Remote Control	May 80	81MP6	2.90	Microprocessor Power Sup.	Jun 81		
ET 159	2.90	10-15V Exp. Scale Voltmeter	Dec 81	\$23.00	ET 599D	2.90	L.R. Remote Ctrlr Power Supply	May 80	81RA4	4.50	Infra Red Relay	Apr 81	\$38.00	
ET 245	2.90	White Line Follower	Nov 77		ET 603	4.90	Mic. Synth	Aug 77	81R4B	2.90	Infra Red Relay	Apr 81		
ET 250	3.50	House Alarm (262)	Aug 80		ET 604	6.04	Metronome	Spt 77	81SP1	2.90	RS232 TRS80 System 80 In.	Jan 81		
ET 255	2.90	Thermometer	Nov 80		ET 606	3.90	Electronic Tuning Fork	Nov 79	81SW1	3.90	TRS80/System 80 Serial In.	Mar 81		
ET 256	2.90	Humidity Meter		\$19.50	ET 607A	2.90	Sound Effects Generator	Aug 81	81MC7	2.90	Moving Coil Preamp	Jul 81		
ET 257	2.50	Universal Relay Board	May 81	\$12.50	ET 607nf	2.90	Sound Effects Generator	Aug 81	81RM2	2.50		Feb 81		
ET 258	2.50	Mini Drill Speed Controller	Jul 81	\$1.00	ET 631-2	7.50	Keyboard Encoder	Apr 77	81DC3B	8.50	Digital/Analog Store. Cro	Mar 81	\$100.00	
ET 259A		Versatile 'Incremental' Timer	Jan 82	\$38.00	ET 635	3.90	Train Steam Whistle	Apr 81	81DC3A	9.50	Digital/Analog Store. Cro	Mar 81		
ET 259B					ET 636	16.90	S7 1100 Mother Board	May 80	81WS10	2.90	Wind Speed Indicator	Oct 81	\$43.50	
ET 260	2.60	Photo Lamp Flasher	Dec 79		ET 637		Cassette Interface	Jan 78	81P6	2.90	Pool/Lotto Selector	Jun 81	\$24.00	
ET 261	2.90	Fog Horn	Dec 79		ET 638A	4.90	Erom Programmer	Jul 78	81A010	3.50	Audio Test Unit Cass.Deck	Oct 81		
ET 262	2.90	Intercom	Dec 79		ET 640	65.00	Memory Mapped VDU	Nov 78	\$148.00	81A010	3.50	Audio Test Unit Cass.Deck	Oct 81	\$47.50
ET 263	2.90	Simple Egg Timer	Dec 79		ET 650A	4.50	Stac Timer	Nov 78	81MC8	9.50	Musicalool IV	Aug 81	\$78.00	
ET 264	2.90	Simple Siren	Mar 80		ET 650B	4.50	Stac Timer	Nov 78	81SG9	4.20	Lad Sandglass	Sep 81	\$22.50	
ET 316	3.50	Transistor Assisted Ignition	May 77		ET 650C	4.50	Stac Timer	Nov 78	81P19			Sep 81		
ET 317	3.50	Car Rev Monitor	Jul 77		ET 660	19.00	Learnners Microcomputer	Oct 81	81C19		Digital Clock Thermometer	Sep 81	\$88.00	
ET 324		Lad Tacho	Aug 80		Key Set (18) To Suit ET660		Colour Option Kit to Suit 660		81SS11	4.90	Slide Cross Fader	Nov 81	\$88.00	
ET 325	2.50	Car Auto Electric Probe			ET 682	69.00	Versatile Erom Card	Mar 81	81GA9	4.90	Photon Torpedo Game	Sep 81	\$28.50	
ET 326	2.50	Exp. Scale Lad Voltmeter	Spt 80	\$12.50	ET 682	69.00	Versatile Erom Card	Mar 81	81MCT	9.50	Universal Timer	Aug 81		
ET 327	2.90	Turn/Hazard Indicator	Oct 80	\$22.00	ET 708	2.90	Aerial Amp	Mar 76	81SW7		Moving Coil Preamp	Jul 81	\$17.00	
ET 328	2.90	Lad Oil Temp Meter	Jan 81	\$15.50	ET 713	4.90	FM Tuner add on	Spt 77	81SM7	2.90	Bagatelle	Jul 81		
ET 329	2.50	Exp. Scale Vehicle Ammeter	Feb 81	\$19.50	ET 717	4.50	Crosshatch Generator	May 78	81VM2	2.90	High Impedance DC Voltmtr	Feb 81		
ET 330	3.90	Car Alarm	Jul 81	\$27.00	ET 726	3.50	R.F. Amp 70W 6/10 Meter	Feb 80	81H4A	2.90	Heart Rate Monitor	Apr 81	\$84.00	
ET 332	2.90	Electronic Stethoscope	Aug 81	\$34.00	ET 730		UHF TV Masthead amp	Apr 81	81H4B	7.50	Heart Rate Monitor	Apr 81		
ET 333		Reversing Alarm	Jan 82	\$18.00	ET 731	4.50	Teletype Modulator	Oct 79	81H4B	7.50	Heart Rate Monitor	Apr 81		
ET 363	3.50				ET 735	3.90	UHF to VHF Converter	May 81	81MA4	2.50	Touch Sensitive Alarm	Apr 81		
ET 417	2.90	Overload Indicator	Aug 73		ET 760	2.50	Video Mod. To Suit 660 Micros	Spt 81	81RC4A	3.50	Infra Red Remote Control	Apr 81		
ET 438		Lad Level Meter		\$11.95	ET 762	3.50	Video Mod. To Suit 660 Micros	Spt 81	81RC4B	2.50	Infra Red Remote Control	Apr 81		
EET 440	8.50	25 Watt Stereo Amp	Mar 75		ET 824	2.90	Slot Car Power Supply	Dec 81	81RC4C	2.75	Infra Red Remote Control	Apr 81		
ET 445	2.20	General Purpose Preamp	Jul 76	\$8.50	ET 825	5.90	Slot Car Controller	Dec 81	81SP5	2.50	Sound Pressure Meter	May 81	\$17.00	
ET 446	3.50	Stereo Limiter	Jul 76				Without Case		81OR7	9.50	Electronic Organ	Dec 81	\$88.00	
ET 449	2.90	Mike Amplifier	May 77		ET 1501A	2.50	Negative Ion Generator	Apr 81	81CH12	3.50	Christmas Decoration	Dec 81	\$18.00	
ET 450A	3.50	Bucket Brigade	Dec 77		ET 1501B	2.50	Negative Ion Generator	Apr 81	81fm10a	4.90	500MHZ Digital Freq.Mtr.	Dec 81	\$136.00	
ET 450B	3.20	Bucket Brigade	Dec 77		ET 1501C	1.50	Negative Ion Generator	Apr 81	81fm10a	4.90	500MHZ Digital Freq.Mtr.	Dec 81	\$136.00	
ET 452		Guitar Practice Amplifier	Jan 80		ET 1503	3.90	Battery Charger	Aug 81	81fm0b	3.50	500MHZ Digital Freq.Mtr.	Dec 81		
ET 453	2.90	AMP Class B. Gen Purpose	Apr 80				E.A.		811012	3.90	Lad Bar Graph Display	Dec 81		
ET 454	3.50	Fuzz Box	Apr 80		Dream 6800 12.50				82ep1	3.90				
ET 455	3.90	Loud Speaker Protector	Mar 80	\$25.50	Dream 6802 12.50				82ep1	7.90	Easy to use Erom Programmer With Plugpac	Jan 82	\$38.00	
ET 457	2.90	Scratch & Rumble Filter	Spt 80		Power Supply to Suit Dream Micro Kit				81wd12a	2.50	Wind Direction Indicator	Jan 82	\$18.00	
ET 458	4.90	Lad Level Meter	Jan 81	\$27.00	HEX Keypad 19 keys				81wd12b	2.50	Wind Direction Indicator	Jan 82	\$18.00	
ET 459A	3.50				75CD7	3.50								
ET 466	7.50	300W AMP Module	Feb 80	\$83.00	75L11	2.50								
ET 467	6.90	4 Input Mike Preamp	Jul 80	\$27.50	76E04	1.00								
ET 470	2.90	60 Watt Amp Module Series 4000	TPV 6	\$26.00	76P09	5.50								
ET 471	9.90	Audio Preamp Series 4000	TPV 6	\$46.50	78TM8	2.90								
ET 472	4.90	Power Supply For Series 4000	TPV 6	\$24.00	78C5	4.90								
ET 473	5.90	Moving Coil Preamp Series 4000	TPV 6	\$34.00	78A06	3.90								
ET 474	2.90	Interface 60W Amp	Jan 80		78N6	3.50								
ET 475	4.90	AM Tuner	Spt 80	\$88.00	78T3	4.50	Photo Timer	Mar 78						
ET 476	6.90	Series 3000 AMP 25W Stereo	Nov 80	\$84.00	78W64	2.90	Pink/White Noise Gen.	Apr 78						
ET 477	4.90				78UT4	4.50	Low Cost VDU Keyboard	Apr 78						
					78UP10	9.50	2650 Extra Ram	Oct 78						
					79SB10	3.90		Oct 79						
					79FE11	2.50	Photo Flash Exposure MTR	Nov 79						
					79PC9	3.90	Pulse Generator	Sep 79						
					79SE3	3.90	Train Model Sound	Mar 79						
					79T11	2.90	Transistor Assisted Ign.	Nov 79	\$34.00					
					79PS11	2.90	Experiments Power Sup.	Nov 79						
					79PC12	2.90	Fan Speed Control	Dec 79						
					79SF10	2.50	Photo Slave Flash	Oct 79						
					79SF9	2.90	Photo Sound Trigger	Sep 79						
					79UPS6	2.50	Universal Power Supply	Jun 79	\$29.50					
					80ST10A	3.50	Stylus Timer	Oct 80						
					80ST10B	2.50	Stylus Timer	Oct 80						
					80TC12	2.90	Bipolar Train Controller	Dec 80	\$28.50					
					80CM3A	4.50	Digital Capacitance MTR.	Mar 80	\$32.50					
					80CM3B	6.50	Digital Capacitance MTR.	Jun 80	\$32.50					
					80PG6	6.50	T.V. Pattern Generator	Aug 80	\$29.00					
					80TV8	3.90	T.V. Cro Adapter	Aug 80	\$29.00					
					80F3	3.20	Audio Prescaler	Mar 80						
					80PP3	2.50		Mar 80						
					80LL7	2.90	Leds & Ladders	Jul 80	\$19.50					
					80B7	2.50	Beat Frequency Oscillator	Jul 80						
					80BM10	2.90	Car Battery Monitor	Oct 80	\$8.50					
					80SA10	9.90	Stereo Amp. Mosfet	Jan 81	\$189.00					
					80DC10	6.50	Digital Storage Cro Ad.	Nov 80	\$78.00					
					80GA12	5.50	Guitar Amplifier	Dec 80		</				

TO ORDER. Heavy items sent Comet Freight! on. Mail Order phone 481-1436. Wholesale Customers phone: RITRONICS WHOLESALE 489-7099.
Mail Orders to P.O. 235 Northcote 3070 Minimum P&P \$2. Add extra for heavy items, registration and certified mail.

Prices spec. subject to change without notice.



±0.013 mm OPTO-SCALE®

Affordable Accuracy from
The Innovators
Bishop Graphics, Inc.



Introducing OPTO-SCALE from Bishop Graphics, the first glass linear measuring instrument to combine precision accuracy, functional design, hi-tech quality and unique performance features in one compact unit...all at an easily affordable price. With OPTO-SCALE there's no need for guesswork. The 610mm (24") precision scale pattern gives you overall accuracy to ±0.013mm (.0005"), with an incredible ±0.005mm (.0002") between adjacent lines.

Adaptable to virtually any precision linear measuring need, OPTO-SCALE is especially useful in the design and manufacture of printed circuit boards. From checking the accuracy of master artwork to the inspection of reproduction negatives and the final product, OPTO-SCALE'S ±0.013mm (.0005") accuracy is your assurance of quality results.

Instantly convertible at a glance, the dual aligned inch/metric scale pattern is chrome etched on the underside of OPTO-SCALE'S thick, stable glass plate. This combined with our unique parallax

eliminator assures accuracy to ±0.013mm (.0005")...even on uneven surfaces. Twin, full focusing, 10 power optics and clear, smooth gliding cursors offer the ultimate in sharp, stable viewing of both your work and OPTO-SCALE'S inch/metric scale pattern. OPTO-SCALE'S sturdy, attractive, black anodized all aluminum frame is engineered for easy portability, yet it's heavy enough to stay where you put it. OPTO-SCALE even comes with its own protective storage container.

So, if you want to improve your linear measuring accuracy, without destroying your budget, choose OPTO-SCALE...affordable accuracy from Bishop Graphics.



**FOR THE COMPLETE OPTO-SCALE STORY...
INCLUDING A FREE OPTO-SCALE
DEMONSTRATION AND BISHOP TECHNICAL
BULLETIN NO. 1023R, CONTACT YOUR LOCAL
BISHOP GRAPHICS DEALER TODAY!**

S.T.
ORGE
OWN
O. PTY. LTD.
Whyalla Street
Whick A.C.T.
19
80 4355
x: AA 62128

NEW SOUTH WALES
CIRCUIT
COMPONENTS
(A/Asia) PTY. LTD.
P.O. Box 70
383 Forest Road,
Bexley N.S.W. 2207
Tel: 59 6550 59 3720
Telex: AA 27197
CIRCOM

QUEENSLAND
L. E. BOUGHEN
& CO.
Cnr. Baroona &
Milton Rds.
Milton Qld. 4064
Tel: 36 1277
Telex: AA 41500

SOUTH AUSTRALIA
GRAPHIC
ELECTRONIC
INDUSTRIES
PTY. LTD.
41A Rundle Street
Kent Town S.A. 4067
Tel: 42 6655
Telex: AA 88646

VICTORIA
CAMDEN ART CENTRE
PTY., LTD.
Post Office Box 117
188-200 Gertrude St.
Victoria 3065
Tel: 41-96633
Telex: 36077 CAMART AA

VICTORIA
STEWART
ELECTRONIC
COMPONENTS
PTY. LTD.
44 Stafford Street,
Huntingdale 3166
Tel: 543 3733
Telex: AA 36908

WESTERN AUSTRALIA
W. J. MONCRIEFF
PTY. LTD.
176 Wittenoom Street,
East Perth W.A. 6000
Tel: 325 5722
Telex: AA 93022

ALL ELECTRONIC COMPONENTS

That's our name . . . that's our game!!!

MAJOR STOCKISTS OF ALL GENERAL RADIO AND ELECTRONIC COMPONENTS

"WE ARE NOW OFFICIAL INTERSIL DISTRIBUTORS"

Check our low prices on these fabulous products by "INTERMIL". O.E.M.'s & Resellers enquiries welcome.

ICM 7211	\$11.84	ICM 7215EV/Kit	\$36.56	ICL 8038 CC	\$6.70
ICM 7226B	\$35.25	(Stopwatch Kit)	\$5.85	ICL 8069 CC SQ	\$3.45
ICM 7556 IPD	\$ 2.20	ICL 7650 CPD	\$4.28	Product & Data Book etc. etc.	\$14.10
ICM 7555 IPA	\$1.70	ICL 7660 CPA			

Prices include Sales Tax. Allow \$2.00 Pack and Certified Post.

**ETI AND EA KITSET SPECIALISTS (LARGEST RANGE IN AUSTRALIA) — TOP QUALITY, LOW PRICES
LEARN WHILE YOU BUILD**

BASIC ETI 660 COMPUTER only \$99. Plus \$5 P/P



Complete with colour option, keyboard, power supply, programmed EPROM, R.F. modulator, case etc.

**\$230 plus
\$8.50 P/P**

Refer ETI October 1981

JOIN THE GOLDRUSH

ETI 1500 KITSET. Super unit featuring:

- Tune and discriminate • 4 modes of operation
- VLF/TR design • Ground balance • Auto balance push buttons • Pre-wound search heads • Very professional unit • Approximately 1/3 price of many similar commercial built up locators • Audio and meter indication. Lets you know when to rejoice

**Price: \$214.64
plus \$8.50 P/P**



All AEC KITSETS contain only top quality prime specifications' components by recognised manufacturers. Don't be misled by other so called "KITS" which do not meet ETI and EA standards.

Give yourself and your Kitset every chance of success.

ALL PARTS COVERED BY MANUFACTURERS WARRANTY

ETI 549 KITSET



Features include:

- Induction balance • Volume and level control • Phone jack
- Dual sensitivity • Audio and meter indication

Price: \$59.31 * plus \$5.00 P&P

ETI 561 KITSET



Features include:

- B.F.O. principle • Crystal controlled • Good sensitivity
- Simple construction • Low cost

Price: \$33.85 * plus \$5.00 P&P

Stac Timer

ETI 650



This unit has four different programmable outputs, clock controlled switch-ons/switch-off times selected days from the seven or eight day cycle can be "skipped". Ideal for operating air conditioning, fish tanks, hi-fi systems, tape recorders, slide and movie projectors and laboratory control etc.

Price: \$150 * plus \$7.00 P&P

E. D. & E. (SALES) PTY. LTD., NOW

ALL ELECTRONIC COMPONENTS

118 LONSDALE STREET, MELBOURNE, VIC. 3000. TEL: 662-3506.

Drum up a storm — with this percussion synthesiser

Design: **Ray Marston**
Development: **Geoff Nicholls**

With this instrument you can simulate drums, cymbals, snares and bongos as well as making an assortment of 'wonderful' noises.

THIS ATTRACTIVE musical instrument has two 'percussion simulator' channels, one to simulate the sound of normal drums only, the other to simulate the sounds of all types of drums, including snares, plus metallic percussion sounds such as cymbals, etc. On each channel, the envelope decay times and the basic musical tones, etc, are fully variable, using the manual controls, to enable a wide range of percussion sounds to be simulated. The outputs of the two channels are mixed internally and can be fed to an external power amplifier from a single output socket. The complete instrument may be powered from a 12 V battery pack (8 x AA cells) or a 12 Vdc plug pack supply.

Design

The synthesiser comprises two essentially similar channels. Channel 1 is

built around a voltage-controlled amplifier (half an NE570N). The input signal is modified to produce the characteristic sharp attack, slow decay envelope of percussive sounds. This is done by the input amplifier, IC1, which drives a rectifier, D1, which charges a capacitor, C1. The voltage on this capacitor drives the envelope input of the VCA via a buffer, IC2. C1 is discharged via RV2 — producing the 'decay', RV2 controlling the rate of decay.

A level detector, IC4, also takes its input from C1, and drives a gated tone generator (IC5, Q1, Q2), the output of which provides signal or tone input to the VCA. Thus when the input transducer is struck, the gated tone generator is triggered and its output is modified or modulated by the envelope signal

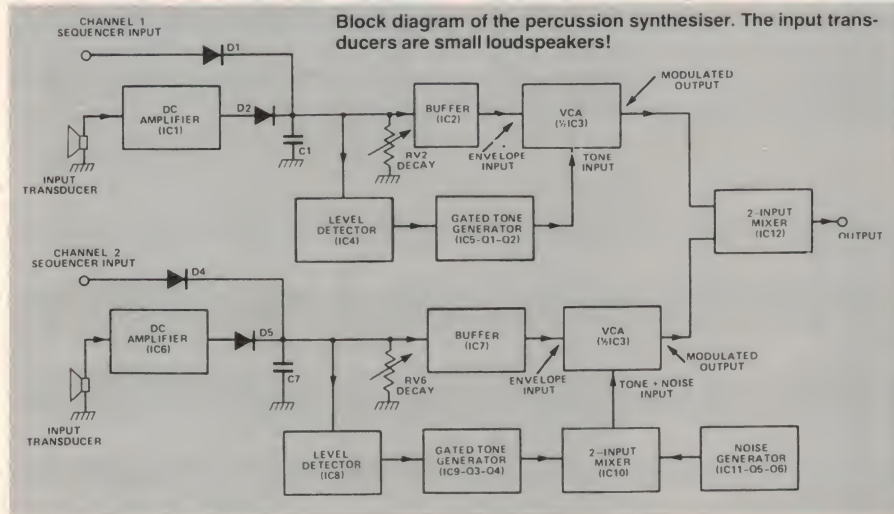


applied to the VCA. The resultant signal is applied to a two-input mixer, IC12.

Channel 2 is largely similar, but has two additions — a noise generator (IC11, Q5, Q6) and a mixer, IC10. The outputs of the noise generator and the Channel 2 gated tone generator are mixed and applied to the signal input of the Channel 2 VCA (the other half of IC3). The 'tone + noise' signal thus produced is modulated in the same way as before and applied to the other input of the two-input mixer, IC12.

Thus sounds involving a combination of tone and white noise (cymbals, for example) may be simulated, or sounds made up predominantly of white noise (e.g. snares) may also be produced.

Provision has been made for a 'sequencer' so that the synthesiser may be operated 'automatically' to produce a 'programmed' rhythm. We will be describing such a project in a forthcoming issue.



Project 469



We housed our project in a light but sturdy ABS plastic case and attached a Scotchcal label to the front panel — artwork for this panel is reproduced on page 126. The two 'transducer' inputs, the output and supply input are located on the rear panel. Small speakers serve as input transducers and are mounted in separate small boxes.

Construction

This is best commenced by doing all the mechanical work. The case we used is made by Sigea Australia, a Melbourne-based firm, and is entirely constructed of ABS plastic. It comprises a U-shaped base, the two turn-ups serving as front and rear panels, plus a U-shaped lid which overhangs front and rear. The lid is secured to the base by four screws, two on either side, beneath which two projections extend, serving as feet. The particular case model we used is designated EC.1002. It measures 210 mm wide by 225 mm deep by 80 mm high, overall, and there is ample room inside. Being plastic, it's easy to drill and cut holes in! We understand some kit suppliers will include this case with their kits. However, if you're assembling all the components yourself then any suitable case of adequate size — remember, there are ten pots on the front panel! — will serve the purpose. If you don't have your case ready-drilled, then that's the first job to tackle. Drilling details for the front panel are given in the accompanying diagram. The pc board may be located conveniently in the base of the box and the input and output jacks, etc, mounted on the rear panel to suit yourself.

Cut the potentiometer shafts to suit the knobs being used. The knobs employed on our prototype are a plastic, slip-on variety that are quite cheap and attractive. Ours were obtained from Jaycar, 125 York St, Sydney. These require about 8 mm of shaft beyond the thread.

If you're using a Scotchcal front panel, carefully attach this to the case front panel. Now, identify which pot goes where on the panel and secure each in position, taking care not to damage the Scotchcal on the panel. Note that, from the rear, all the pots face one way — with their terminals to the left. All

the knobs are best put on at this stage.

Now you can commence assembly of the pc board. There are five links on the board and these should be inserted first. Follow with the resistors and green-caps. If you are using IC sockets, put these on next, taking care you orient them the correct way. Note that all except IC3 face the same way. The electrolytic capacitors and diodes may be mounted next; make sure you put them in the right way round. Next come the transistors. Watch Q1 and Q3 — the board was originally laid out for transistors having an e-c-b pinout, but most commonly available types have an e-b-c pinout. You'll have to cross the base and collector legs for Q1 and Q3, unless you have transistors with the e-c-b pinout.

The pots may be wired next. Wiring between the pc board and the pots is done with ordinary hookup wire. Note that single 0 V hookup wire is best run to the 'earth' end of RV2 first and then to the appropriate lugs of RVs 4, 6, 8 and 10. The 0 V wire connects to the most anticlockwise terminal, when looking at the rear of the pot (see accompanying diagram). Now run the other wires between each pot and the pc board.

Wire up the input and output sockets. Channel 1 input is wired to RV1,

channel 2 to RV5. Wire the power supply leads from the board to the plug pack input socket. Check the polarity of your plug pack — some are wired with -ve to the inner connector, some with +ve.

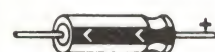
The input 'transducers' are simply small speakers. These may be conveniently mounted in a small jiffy box. You can glue them straight in the bottom — cone down. Tapping the base of the box will cause the speaker to give an output signal. Hook them up with the shielded cable.

Note that the input socket needs to be a stereo, switched type connected such that the two inputs are shorted to 0 V when the input is disconnected. This prevents the input op-amps of each channel from 'floating' with no input, in which case the op-amp offset will give rise to a continuous output — which you don't want!

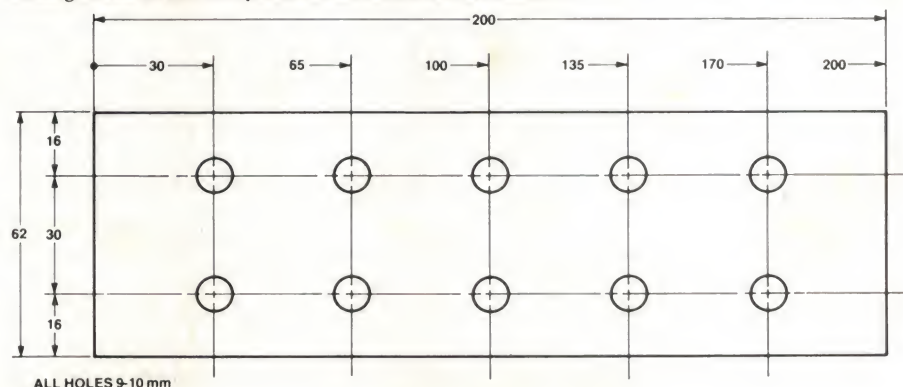
If you're powering this unit from a battery pack, we suggest you obtain one which takes eight 'AA' cells and provides a series connection to produce a nominal 12 V. They come with a handy press-fit connector as found on 9 V transistor radio batteries. The battery pack may be attached to the rear panel in a vertical position, which affords ►

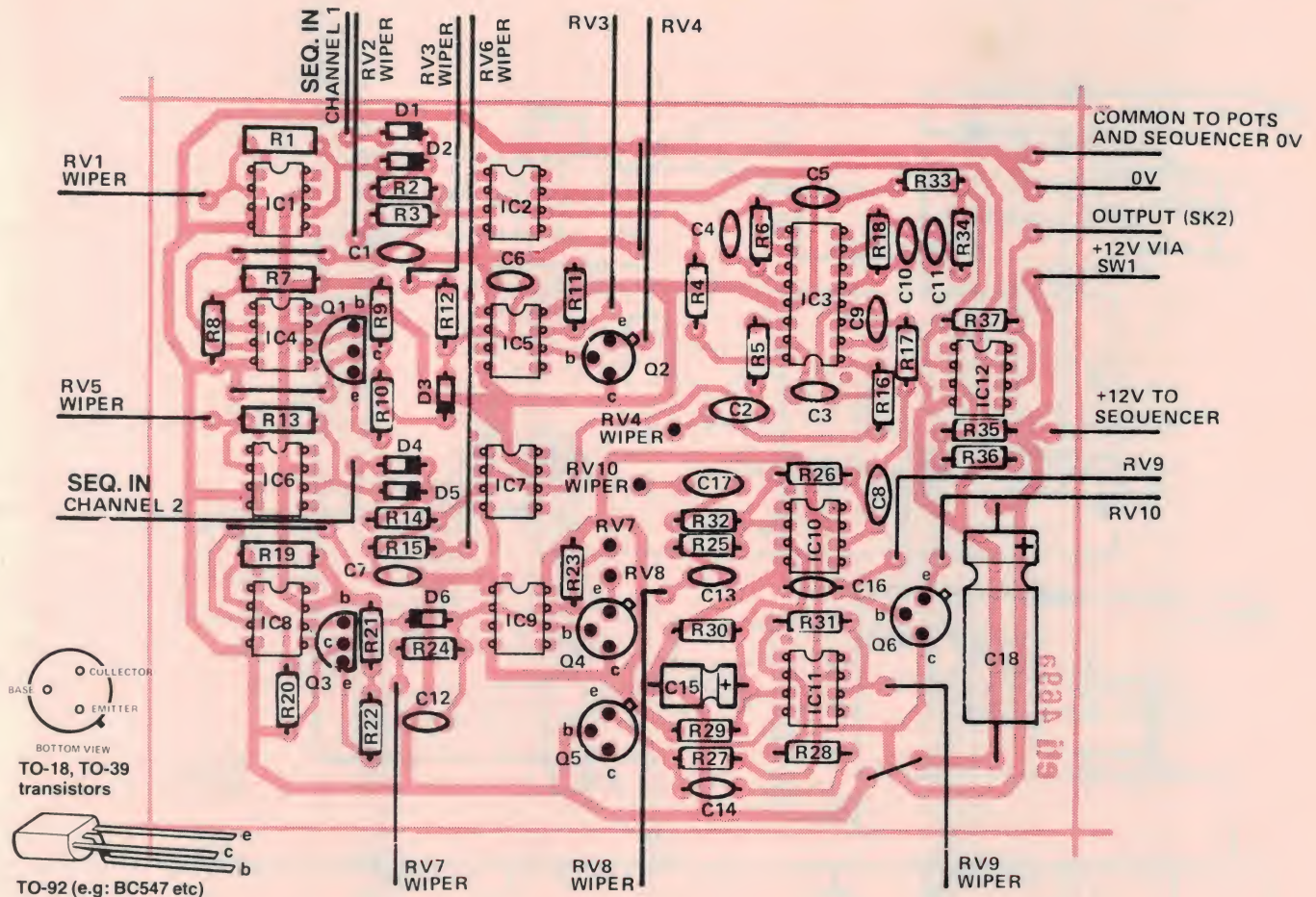


NOTCH OR SPOT AT THIS END

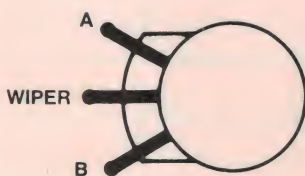


electrolytic





Component overlay. Note that the board has been laid out for the Q1 and Q3 transistors with an e-c-b pinout. Watch the pinout of the transistors you use; you may have to cross the base and collector leads.



POTENTIOMETER CONNECTIONS

POT.	A	WIPER	B
RV1	TO SK1, CH.1	TO PCB, R1	—
RV2	—	TO PCB, R3	TO 0 V
RV3	TO PCB, R11	TO PCB, R12	—
RV4	TO PCB, Q2	TO PCB, C2	TO 0 V
RV5	TO SK1, CH.2	TO PCB, R13	—
RV6	—	TO PCB, R15	TO 0 V
RV7	TO PCB, R23	TO PCB, R24	—
RV8	TO PCB, Q4	TO PCB, C13	TO 0 V
RV9	TO PCB, IC11	TO PCB, C16	—
RV10	TO PCB, Q6	TO PCB, C17	TO 0 V

PARTS LIST — ETI-469

Resistors all 1/2W, 5%

R1, 13, 25, 26, 31 1M
 R2, 12, 14, 24 4k7
 R3, 15 33k
 R4, 7, 16, 19, 27, 33, 34, 37 100k
 R5, 17 22k
 R6, 18, 35, 36 47k
 R8, 20 6k8
 R9, 21 1k
 R10, 22 680R
 R11, 23 2k2
 R28, 32 10k
 R29, 30 56k

Capacitors

C1, 3, 5, 6, 7, 9, 11, 12, 13 100n ceramic
 C2, 8, 14, 17 220n greencap
 C4, 10 33p ceramic
 C15 10u/25 V axial electro.
 C16 10n ceramic
 C18 1000u/16 V axial electro.

Potentiometers

RV1, 4, 5, 8, 10 50k lin.
 RV2, 6 2M lin.
 RV3, 7 100k lin.
 RV9 250k lin.

Semiconductors

IC1, 2, 4, 6, 7, 8 CA3140
 IC3 NE570N
 IC5, 9 7555
 IC10, 11, 12 741
 Q1, 3 BC557
 Q2, 4, 5, 6 BC549

Miscellaneous

SK1 stereo 6.5 mm phone skt with switch
 SK2 mono 6.5 mm phone skt
 LS1, LS2 50 mm, 8 ohm speakers

ETI-469a pc board; 10 knobs; case to suit (e.g.: Sigee EC.1002); 12 Vdc plug pack (if required); two small jiffy boxes; Scotchcal panel; wire etc.

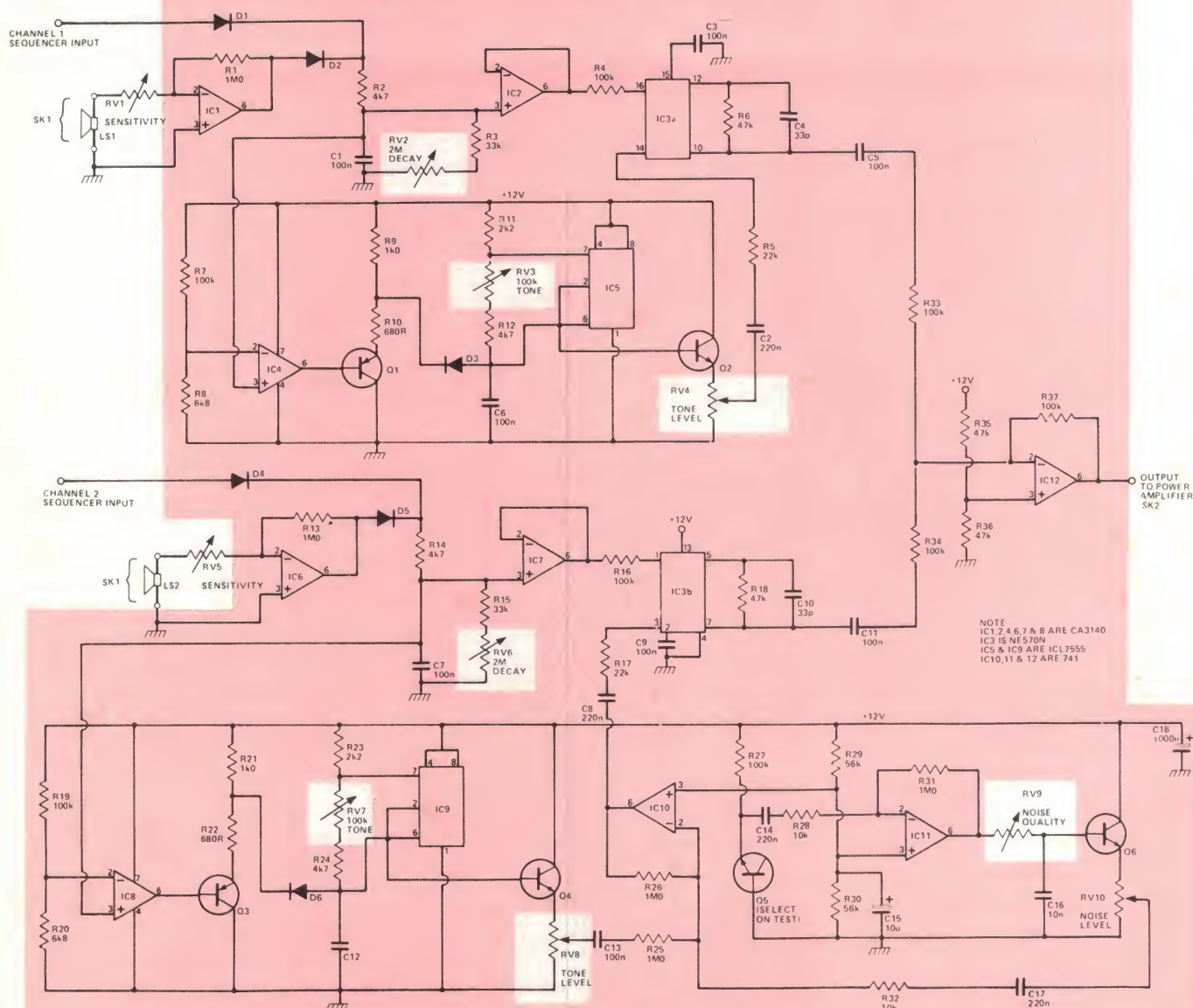
Price estimate

We estimate the cost of purchasing all the components for this project will be in the range:

\$85 — \$95

Note that this is an **estimate** only and **not** a recommended price. A variety of factors may affect the price of a project, such as — quality of components purchased, type of pc board (fibre-glass or phenolic base), type of front panel supplied (if used), etc — whether bought as separate components or made up as a kit.

Project 469



HOW IT WORKS — ETI-469

Overall operation is explained in the main text. As the two channels are similar, we'll start the circuit description with the operation of Channel 1, as all the circuit blocks in this channel are common to both channels.

CHANNEL 1

When used in the manual mode the instrument is played using an external transducer such as a speaker (LS1), which is connected to the input of a high-gain dc amplifier, IC1. Each time the transducer is tapped, the output of IC1 jumps abruptly positive and rapidly charges C1 via D2-R2; C1 then discharges exponentially via R3-RV2, to produce the characteristic fast attack/slow decay modulation waveform of a percussion instrument. The waveform is then fed to one half of the dual VCA, IC3, via unity-gain buffer IC2, where it is

used to control the gain of the VCA.

Note that the C1 modulation generator can be activated by either the transducer or by a pulse signal fed to C1 via D1-R1 from the independent sequencer circuit. The C1 voltage is monitored by comparator IC4, which gates on astable IC5 whenever the C1 voltage exceeds a few hundred millivolts. The astable generates a symmetrical ramp waveform, which is buffered by Q1 and fed to the 'tone' input of the VCA via level control RV4. The tone of the astable can be varied over the range 83 Hz to 1.4 kHz with RV3.

Thus each time the channel is activated (by the transducer or by a sequencer) a modulation waveform is fed to one input of the VCA and a tone signal is fed to the other, to produce a modulated tone signal at output pin 10 of IC3. The signal is fed to one input of a two-input

mixer, IC12. A wide variety of drum sounds can be simulated by suitable adjustment of RV2, RV3 and RV4.

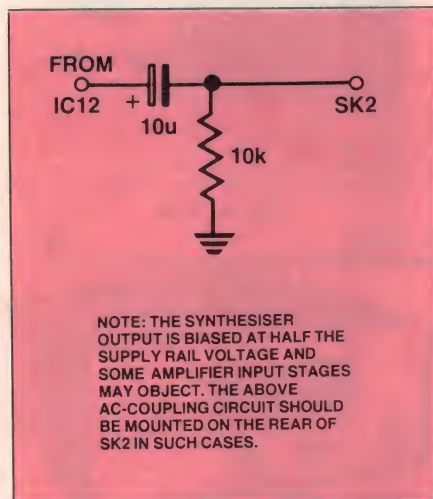
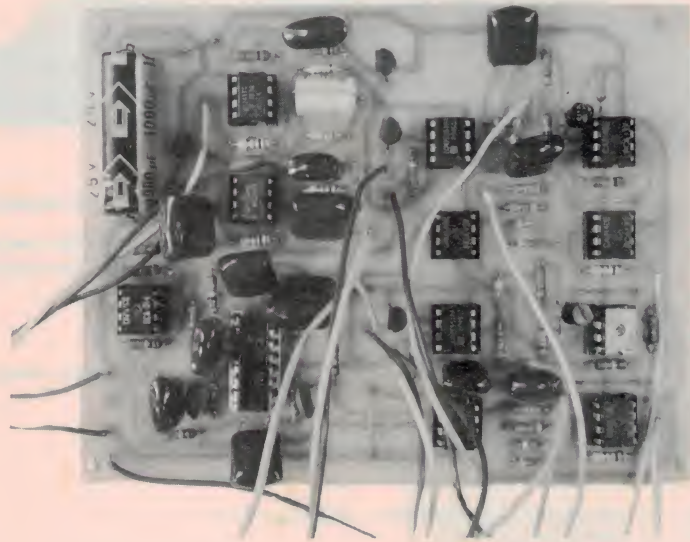
CHANNEL 2

Channel 2 is similar to channel 1, except that the output of the tone generator (from RV8) is fed to the VCA via a two-input mixer designed around IC10. The other input to this mixer is derived from a noise generator designed around Q5-IC11 and Q6. Here, the reverse-biased base-emitter junction of Q5 is used as a noise source and the noise signal is then amplified by IC11, filtered by RV9-C16 and made available via level control RV10.

The instrument is powered from a 12 V supply, derived from eight 1V5 cells. This supply is also used to power the auto-manual sequencer unit.

access to both sides for changing the batteries when necessary. A strip of double-sided sticky pad is ideal for attaching the battery pack. Note that you will need a power switch. A small toggle switch can be mounted on the rear panel in a convenient position or you can get a switch pot for one of the controls (i.e: RV1 or RV5).

Having wired everything up, make the usual visual checks for missed solder joints, solder bridges, dry joints, incorrectly orientated components, etc. Connect the input transducers and the plug pack and connect the synthesiser output to the input of an amplifier. Set the channel 2 sensitivity control fully anticlockwise ('off'). Set all the channel 1 controls to mid position and turn the



unit on. It'll probably go 'boing'. Now, tap the channel 1 transducer. You should get a clear 'boing' sound output. If not, check your wiring. Don't forget to check that power is getting to the pc board. If all is well, set all channel 2 controls to the mid point and tap the channel 2 transducer. You should get a 'boing' mixed in with a 'crash'. If it tests out OK, finally secure the pc board in place and put the case together.

Now, play to your heart's content! You will need to explore how each control functions — how it affects the sound produced — in order to be able to use the synthesiser effectively. There's no substitute for a good fiddle!

If it doesn't work

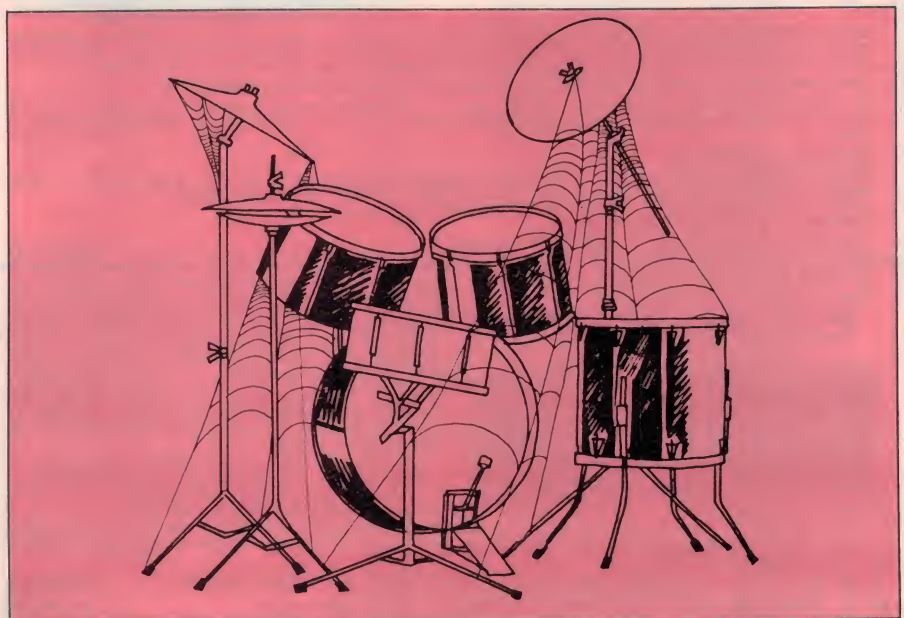
There are a few fundamental steps you can take to isolate a fault or faults if the unit doesn't work first off. Obviously, make sure power is getting to the pc board. Check this at the pc board. The easiest place to do this is across C18. Trace your power input wiring if all is not as it should be. Next, check that you

have all five links installed.

Channel 1 doesn't work? Attach a temporary lead to the channel 1 sequencer input (anode of D1). Briefly touch it on the +ve terminal of C18. You should get a 'boing' in the output (all controls set mid-way). If this works, but tapping LS1 doesn't, look for a wiring fault or incorrect orientation of IC1. Otherwise, there's something awry between IC2, IC3 and IC12. Try temporarily bridging the junctions of R5/C2 and R33/C5. Temporarily disconnect one end of D3. Turn the unit on and you should have a tone output. If not, then look for a fault around IC5, Q2 and possibly IC12. You could use a crystal earpiece to check for a tone at the emitter of Q2 to see that IC5 and Q2 are

functioning. If the temporary bridge gives a tone output then check for a fault around IC3. Check that its orientation is correct — it faces the opposite direction to all the other ICs. Remove the bridge and restore D3 when you get it going.

Similar procedure can be applied to channel 2. If the noise generator does not produce noise, try connecting a crystal earpiece to the emitter of Q6. If no noise is present, try using a different transistor for Q5. Note that pin 3 of IC11 should be around half the supply rail voltage. Same goes for IC10. If not, check R29 and R30 for the right values and that IC10 and IC11 are correctly orientated.



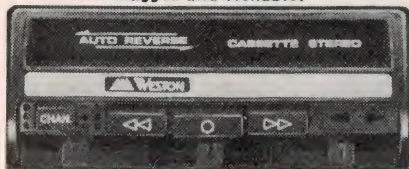
WESTON CAR SOUND

- ★ Superb Japanese Engineering.
- ★ Rugged and Reliable.
- ★ State of the Art Electronics.

WESTON CAR SOUND AUTO REVERSE CASSETTE DECK CS100

★ 8 watts per channel ★ Quality patented tape transport mechanism ★ Fast forward and rewind ★ All IC circuitry ★ Frequency response 33-10 KHZ. Dimensions: 48H x 120W x 165D.

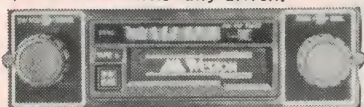
Rugged and Reliable!



C 9110 \$69.50

AM/FM CASSETTE CS500

★ Quality AM/FM receiver ★ Sensitivity 3UV FM, 10 UV AM ★ 6 watts per channel power output ★ 33-10 KHZ frequency response ★ Wow and flutter less than .2% ★ Output impedance 4-16 OHMS ★ Power source DC 13.2V neg. ground 350 MA No. sig. to 2.5 amps. Both channels fully driven.



C 9120 \$89.50

CS4000 THE POWER HOUSE MASSIVE 25 WATTS/CHANNEL WITH DIGIT FREQUENCY READOUT & DIGITAL CLOCK



HIGH FIDELITY AM/FM CASSETTE

Super sensitive AM/FM receiver with superb fidelity inbuilt amplifier. When you feel you owe it to yourself to go "top shelf" this is the one, and at our price why not anyway!

DIGITAL DISPLAY gives continuous readout of signal frequency or at the flick of a switch becomes a digital clock. **DX-LOCAL** sensitivity switch. **FREQUENCY RESPONSE** 40 HZ-10 KHZ. **STANDARD IN-DASH MOUNTING.**

C 9130 \$179.50

OVER 1,000 KITS TO CLEAR ½ PRICE!

Famous ETI Project Electronics Kits

		Normally	NOW
K 0141	Continuity Tester	\$4.00	\$2.00
K 0143	Heads or Tails	\$3.50	\$1.75
K 0145	500 Second Timer	\$4.50	\$2.25
K 0147	Morse Practice Set	\$3.50	\$1.75
K 0511	Battery Saver	\$3.90	\$1.95
K 0148	Buzzboard	\$3.90	\$1.95
K 0161	Basic Amplifier	\$5.50	\$2.75
K 0166	Temperature Alarm	\$4.90	\$2.45
K 0167	Singing Moisture Meter	\$4.90	\$2.45
K 0163	Electronic Bongos	\$5.00	\$2.50
K 0162	Simple AM Tuner	\$6.50	\$3.25
B 9994	Project Elect. Bk. (Features all above kits)	\$4.75	\$2.40

Famous LANKAR SPEAKER SYSTEMS

We are absolutely delighted with our range of LANKAR Car Sound Speaker Systems — if you've already got a set you will know what we mean — beautifully engineered, physically and acoustically. Definitely Australia's best value for money in speakers. All kits are supplied C/W mounting hardware, terminals, cable etc.

* ALTRONICS DIRECT * IMPORT ELECTRONICS CATALOGUE

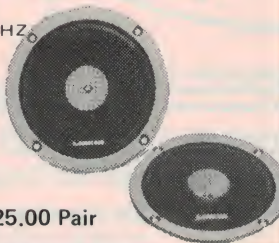
Our first edition catalogue was released with Electronics Australia Magazine March 1982. If you missed out send \$1.00 to cover packing and postage — You will be amazed at the savings ALTRONICS offer in comparison to the "Heavyweights" of the Electronics Component Industry.

20 WATT TWIN CONE 5"

5" (120mm) slim line one piece fixing, air suspension type
100 HZ - 12,000 HZ
Impedance: 4 OHM
Magnet: 5 oz.

Max. Power
15W

C 9320 \$25.00 Pair



FLUSH OR REAR MOUNT COAXIAL CONVERTIBLES

Use them as they are or discard the PVC removable shells and flush mount.
15 watt max. input. Frequency response: 100-15,000 HZ. Impedance: 4 OHM
Magnet weight: 10 oz. Our Top Seller!



C 9312 \$39.50



20 WATT TWIN CONE 4"

4" (106 mm). air suspension speakers. C/W grills and fixing screws, cable etc.
110-15,000 HZ.
Impedance: 4 OHM
Magnet: 6 oz.

Max. Power
20W

C 9325 \$29.95 Pair



GPX 650 3 WAY SEPARATE SPEAKER SYSTEM

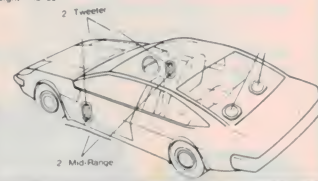
Positively brilliant and worth every cent!
Supplied with complete installation kit, screws, wiring and connectors.

C 9350 \$79.50

3-WAY SEPARATE SPEAKER SYSTEM

- Woofer: 6" (156 mm) Airsuspension type
- Mid-Range: 2" (50 mm) Airsuspension type
- Tweeter: 2" (50 mm) Horn type
- Frequency Response: 30-18,000 HZ
- Input Power: Nominal 20 Watt Maximum 40 Watt
- Impedance: 4 ohm
- Magnet Weight: 10-oz

Max. Power
40W



30 WATT TRIAXIAL
136mm (5.3 in.). 80-22 KHZ, 4 OHM
Impedance, weight 800 gm.

C 9230 Pair including grills \$59.50

60 WATT TRIAXIAL
156mm (6 in.). 80-22 KHZ, 4 OHM
Impedance, weight 1.3kgs.

C 9260 Pair including grills \$89.50

VIVANCO SPEAKERS
Top of the line car stereo speakers. In the classic tradition of fine motoring such as Mercedes and Daimler we now proudly offer a limited range of true natural fidelity Vivanco Speaker Systems. As you may guess, they are not cheap-but then fine reproduction never was!

60 WATT THREE WAY BOX SPEAKERS

Air suspension bass driver.
50-22 KHZ, 4 OHM Impedance, weight 2.8 kgs. Dimensions: 226W x 130H x 179D.

C 9270 Pair inc. wiring \$169



STOP PRESS!! AC ADAPTORS



All Brand New
All S.E.C. Approved
M 9990 4.5V 150Ma
M 9991 6V 150Ma
M 9992 9V 150Ma
All a CRAZY \$4 each
Great for Calculators,
Portable Radios, Dictation
Recorders, and for
charging NICAD Batteries.

\$2 DELIVERY AUSTRALIA WIDE We process your order the day received and despatch via Australia Post. Allow approx. 7 days from day you post order to when your receive goods. Weight limited 10kgs.

\$4 DELIVERY AUSTRALIA WIDE We process your order day received and despatch via JetService for delivery next day.

BANKCARD HOLDERS CAN PHONE ORDER UP TO 8PM (EST) FOR NEXT DAY DELIVERY — SOUNDS INCREDIBLE DOESN'T IT? Alright you cynics just try us! Weight limit 3.3kgs. JetService cannot deliver to P.O. box numbers (Australia Post would have a fit).

\$10.00 HEAVY HEAVY SERVICE — AUSTRALIA-WIDE All orders over 10kgs must travel on the heavy service, that is — road express. Delivery time 7 days average.

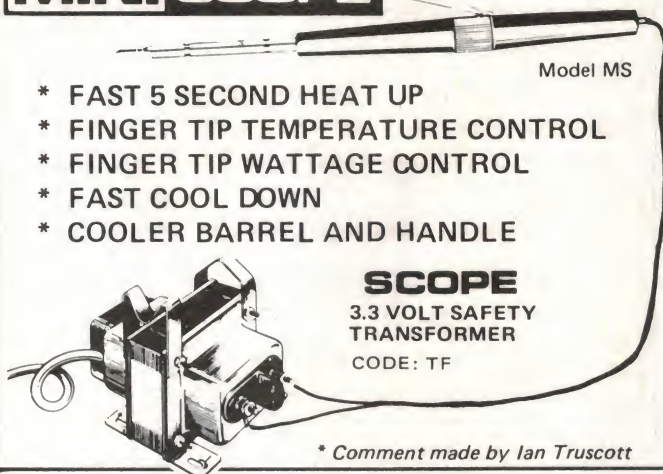
ALTRONICS
105 Stirling St. PERTH
(09) 328 1599
for instant service

All MAIL ORDERS:
BOX 8280 PERTH
Stirling St. WA 6000

Manual Temperature Controlled
5 Second Heat.

• 'BEST VALUE FOR MONEY'

MINI SCOPE



- * FAST 5 SECOND HEAT UP
- * FINGER TIP TEMPERATURE CONTROL
- * FINGER TIP WATTAGE CONTROL
- * FAST COOL DOWN
- * COOLER BARREL AND HANDLE

SCOPE
3.3 VOLT SAFETY
TRANSFORMER
CODE: TF

* Comment made by Ian Truscott

IAN J. TRUSCOTT ELECTRONICS

CNR EASTFIELD & BAYSWATER ROADS,

SOUTH CROYDON, VICTORIA

TELEPHONE 723 3860

Semi Conductor Specials: (While stocks last)

BLX67	\$6.50
2N4427	95 cents
AC187	75 cents
AC128	75 cents
2SD186	40 cents
(GER.,NPN.,25V)	
OA91	15 cents
(\$12 per 100)	
BA102	45 cents
(\$40 per 100)	
BZX79/C11	10 cents
(\$8 per 100)	
BYX 21 L/200R	\$1.30

WE CARRY A COMPREHENSIVE RANGE
OF ELECTRONIC COMPONENTS
AT VERY KEEN PRICES

THE MPT03 MICROCOMPUTER VIDEO HOME ENTERTAINMENT SYSTEM

One of the worlds most advanced T.V. games—High resolution graphics. Create stunning realistic video action.

FEATURES:

- Large memory size enables sophisticated games requiring high skill level response and good reasoning.
- Full color high resolution graphics screen display.
- Realistic sound effects.
- Many game options and variations are available.
- Different keyboard overlays are supplied with each game.

NO BATTERIES—
MAINS ADAPTOR INCLUDED
CONNECTS DIRECTLY INTO
75 OHM CO-AX
TV ANTENNA INPUT
(A 75/300 BALUN IS SUPPLIED
FOR 300 RIBBON CONNECTION)

MPT03 VIDEO GAMES CARTRIDGES NOW IN FULL COLOUR LIBRARY PACKS.

MG301 Soccer (3D)
MG302 Capture
MG303 Basketball
MG304 Spacemission
MG305 Baseball (3D)
MG306 Alien Invader
MG307 Math. Logic
MG308 American Football (3D)
MG309 Video Chess
MG310 Bowling (3D)
MG311 Breakaway
MG312 Sea Battle
MG313 Missile War

25 games will be
on sale by June 82 and
over 36 games by Christmas.



RADIO PARTS GROUP

MELBOURNE AUSTRALIA
562 Spencer St., West Melb. 3003
(03) 329 7888
1103 Dandenong Rd., E. Malvern
(03) 211 8122



Please send me QTY ☐ MPT03 @ \$199 \$..... Total

Also send me the following games cartridges:
MG301 MG302 MG303 MG304 MG305
MG306 MG307 MG308 MG309 MG310
MG311 MG312 MG313

@ \$33.70 \$..... Total

Enclosed cheque/money order or please debit my
Bankcard No. or Diners Club No.

Signed

Address

Postcode..... ETI APRIL

TURTLE TALK™ \$240.00 + Tax Speech Generation at an incredibly low price

For Plugging into the Tasman Turtle™ to give the world's first talking robot for general use, or as a stand alone board for special projects, talking keyboards, aids for disabled or linguistic experiments.

FEATURES

- Vocabulary expansion by simply plugging in more ROMS • Standard 143 word vocabulary all the letters of the alphabet and all numbers • Expandable to approx. 600 words • Unlimited combinations of words to form phrases, sentences, etc.

THESE FEATURES ALLOW PHONEME RECONSTRUCTION METHODS

- Interrupt facility to use the start of words • Mute facility to allow use of the internal parts of words • Command facility allows words to be cut short • Prefix and suffix words for combinations

All circuitry on board for interfacing, ROM expansion, power supplies and audio amp.

EDUCATIONAL

ROM's with French, German, Italian and other languages can plug in also. Have many languages on the one board! Both American and European

English available. Spelling is determined by the programmer. Comprehensive Manual with applications included.

INTERFACING CIRCUITING ON BOARD

Two interfacing methods can be used with many variations for each:

— Data Control Interfacing uses multiplexed data bus.

— Direct Control Interfacing uses parallel port control pins.

Can be used with all popular micro-computers including System 80, TRS 80, Apple II, Superboard II, etc.

Can even be used as stand alone board with discrete circuitry or switches. Have your message spoken to visitors at the door while you are away. Have the radio tell you what station it is on.

INDUSTRY

Suitable for process control and alarm warnings.

PROGRAMMING

Uses simple POKE and PEEK instructions. One line of programming for any word.

Available from: **FLEXIBLE SYSTEMS**

219 Liverpool Street, HOBART, Tasmania. 7000. Australia. Ph (002) 34 3064

TASMAN TURTLE & TURTLE TALK ARE TRADE MARKS OF FLEXIBLE SYSTEMS

CLAMP METER

MODEL YF-700

Top of the range model AC
Voltage 150V 300V 600V AC
Current 6A 15A 60A 150A
300A. Resistance 5kΩ
(Midscale 200Ω)

was \$49.99

NOW ONLY

\$43.55

DISCOUNT DISC DRIVES COMPUTERS

PRINTERS	
ITOH 8300 PARALLEL	\$668 + TAX
ITOH 8300 SERIAL	\$730 + TAX
ITOH 1500 PARALLEL	\$1515 + TAX
(DAISYWHEEL)	
ITOH 1500 SERIAL	\$1555 + TAX
(DAISYWHEEL)	
ITOH 8510 PARALLEL	\$910 + TAX
ITOH 8510 SERIAL	\$1015 + TAX
(GRAPHIC ETC)	

RITRON COMPUTER GRADE P/S
+5V reg 10A 16V unreg (r 1A
KIT \$79.95 inc
Built and tested \$99.50

ETI636 MOTHERBOARD
7 Slot Motherboard \$90.00
Built and Tested \$120.00
ACTIVELY TERMINATED

INTERSIL LCD \$34.50 3 1/2 DIGIT PANEL METER KITS

Build a working DPM in 1/2-hour with
these complete evaluation kits.
Test these new parts for yourself with inter-
sil's low cost prototyping kits com-
plete with A/D converter and LCD dis-
play (for the 7106) or LED display (for
the 7107) Kits provide all materials in-
cluding PC board, for a functioning panel
meter ICL7106EV (LCD)

P.C. EDGE CONNECTORS



S100 gold plated wire wrap	\$8.50
S100 solder tail	\$6.90
D2 Motorola bus	
43/86 solder tail	\$8.50
43/86 gold plated wire wrap	\$11.50

10 TURN POTENTIOMETERS

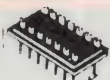
Stock resistance values

50R, 100R, 200R,
500R, 1K, 2K, 5K,
10K, 20K, 50K,
100K

Spectrol model 534 1/4" shaft
Price 1-9 \$9.50
10 + values may be mixed \$8.90

DIP PLUGS

Ideal for use with flat
ribbon cable or to
mount components on



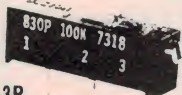
14 pin \$1.20
16 pin \$1.40
24 pin \$1.20
40 pins \$5

POWER TRANSFORMERS

SPECIALLY DESIGNED FOR
MICROCOMPUTERS

- Good regulation electrostatic shield
- RI 810
8V @ 10A x 15V @ 1A \$26.50
- RI 820 8V @ 20A 15V @ 1A
15V @ 3A \$36.50

20 TURN CERMET TRIM POT



SPECTROL 43P ACTUAL SIZE

STOCK RESISTANCE VALUES
10R, 20R, 50R, 100R, 200R, 500R, 1K,
2K, 5K, 10K, 20K, 50K, 100K, 200K,
500K, 1M, 2M
1-9 \$1.40
10-99 \$1.30
100 \$1.20
Values may be mixed.

Hexadecimal Keypad

\$28.50 each



19-key pad in-
cludes 1-10 keys
ABCDEF and 2
optional keys and
a shift key
Ideal for dream
project

MULTIDIALS



Dials to suit 10 T Pots
Model 21 1 1/8" dia \$16.50
Model 16 9" dia \$12.50
Model 18 1" x 1 1/2" dia \$21.50

RS232 & "D" TYPE CONNECTORS

PART NO	DESCRIPTION	1-9	10-25	25+
DE 9P	9 PIN MALE	\$3.50	\$3.50	\$3.10
DE 9S	9 PIN FEMALE	4.50	4.20	3.90
DE 9C	9 PIN COVER	2.20	2.10	1.90
DA-15P	15 PIN MALE	4.50	4.20	3.90
DA-15S	15 PIN FEMALE	5.10	4.90	4.70
DA-15C	15 PIN COVER	2.30	2.10	2.00
DB-25P	25 PIN MALE	5.90	5.60	5.10
DB-25S	25 PIN FEMALE	6.90	6.60	6.10
DB-25C	1 pc Grey Hood	2.40	2.20	2.00
DB-25C2B	2 pc Black Hood	2.80	2.70	2.50
DB-25C2G	2 pc Grey Hood	2.70	2.50	2.40
DC-37P	37 PIN MALE	7.90	7.50	7.10
DC-37S	37 PIN FEMALE	10.90	9.90	9.10
DC-37C	37 PIN COVER	4.90	4.50	4.10
DH S	Hardware set (2 Pairs)	2.10	1.90	1.80

cermet single TURN TRIM POT

Spectrol model 63P
ACTUAL SIZE



STOCK VALUES
10R, 20R, 50R, 100R, 200R, 500R, 1K,
2K, 5K, 10K, 20K, 50K, 200K, 500K,
1M, 2M

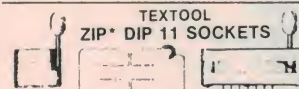
1-9 \$1.00
10-99 0.90
100 0.80

Values may be mixed.

DIP SWITCHES SPST

P N	No of Switches	Price
SD3	3	\$1.60
SD4	4	1.70
SD5	5	1.90
SD6	6	2.30
SD7	7	2.40
SD8	8	2.50
SD9	9	2.70
SD10	10	3.00

DIP SWITCHES SPST



16 Pin Zip* Dip 11 \$11.50
24 Pin Zip* Dip 11 12.50
40 Pin Zip* Dip 11 17.50
*Zero Insertion Pressure

INCREDIBLE MEMORY AND DISC DRIVE PRICES

2708	1.9 10-25 25+
2716	4.90 4.00 3.90
2716	4.80 4.20 3.90
2732	8.00 7.50 7.00
4116 (200nS)	1.95 1.80 1.75
4164 64K Dynamic	11.00 10.00 9.50
M58725P (2K x 8)	10.00 9.00 8.50
Static	
(As used in new 64K Static S100 PCB)	
ALL PRICES INCLUDE SALES TAX	

DISK DRIVES

MPI 51 \$275.00 + 17.5% ST.
MPI 52 \$385.00 + 17.5% ST.
MPI 91 \$415.00 + 17.5% ST.
MPI 92 \$515.00 + 17.5% ST.

TANDON

TM100-1 \$295.00 + 17.5% ST.
TM100-2 \$385.00 + 17.5% ST.
TM100-3 \$415.00 + 17.5% ST.
TM100-4 \$515.00 + 17.5% ST.

BUILD YOUR OWN SPEAKERS WITH PHILLIPS

PART No	PRICE
AD0140TB	\$11.86
AD016101TB	\$16.95
AD01605-TB	\$16.54
AD0162-T15	\$18.78
AD0162-T15	\$13.03
AD0162-TB	\$13.77
AD0210-SQ8	\$32.70
AD02160-SQ8	\$36.91
AD02161-SQ8	\$33.46
AD01000-W8	\$52.72
AD012100-HP8	\$85.10
AD012100-M15	\$79.11
AD012100-M8	\$79.11
AD012100-W8	\$53.99
AD012200-W8	\$73.12
AD012250-W8	\$90.52
AD012650-W8	\$73.12
AD02273-T8	\$5.03
AD04060-W8	\$19.06
AD05060-SQ4	\$22.05
AD05060-SQ8	\$22.05
AD05060-W8	\$17.59
AD05061-MB	\$17.09
AD070601-W8	\$20.40
AD070620-M8	\$21.54
AD07063-M8	\$20.78
AD070630-M8	\$20.78
AD070650-W8	\$26.96
AD07066-W8	\$26.96
AD080601-W8	\$20.24
AD08061-W8	\$20.24
AD080652-W8	\$26.20
AD08066-W4	\$27.66
AD08081-M8	\$9.81
AD0910-M8	\$41.11
ADF1600-8	\$19.44
ADF500-4500-8	\$19.44

DIODES

	10-99	100+
IN4001	6c	5c
IN4002	6c	5c
IN4004	7c	6c
IN4148	5c	4c
IN5404	30c	25c
IN5408	35c	30c
IN4007	12c	11c

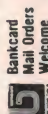
HEATSINKS

High Thermal Capacity Black Anodised

	1-4	5-9	10-49	50-99	499	plus
	\$	\$	\$	\$	\$	\$
HS1 - 38mm						
1 85	175	150	135	100	0.90	
HS2 - 75mm						
3 00	290	250	200	200	1.50	
HS3 - 150mm						
5 80	540	490	380	290	2.70	
HS4 - 225mm						
8 10	760	710	590	450	4.30	
HS5 - 300mm						
8 90	840	790	650	490	4.60	
Unanodised						
HS11 - 38mm						
1 40	120	100	0.90	0.80	0.70	
HS12 - 75mm						
2 50	220	190	160	125	1.20	
HS13 - 150mm						
4 90	450	400	320	245	2.40	

BLANK CASSETTES T.D.K.

TDK ADC60	1 for \$3.60	10 for \$26.00
TDK DC60	1 for \$2.10	10 for \$18.00
TDK ODC60	1 for \$3.50	10 for \$31.00
TDK SAC60	1 for \$3.30	10 for \$29.00
TDK SAXC60	1 for \$5.70	10 for \$46.00
TDK DC90	1 for \$3.05	10 for \$21.00
TDK ADC 90	1 for \$3.50	10 for \$28.00
TDK SAC 90	1 for \$4.20	10 for \$37.00
TDK ODC90	1 for \$4.70	10 for \$45.00
TDK SAXC90	1 for \$5.50	10 for \$49.00
TDK DC120	1 for \$4.50	10 for \$37.00
TDK ADC120	1 for \$5.40	10 for \$46.50



Please debit my Bankcard.

Bankcard No.

Expiry Date.

Name.

Signature.

Post & Pack \$2.50 small kits, heavier kits add extra postage.

Prices subject to change without notice. Send 60c and SAE for free price list and
inclusion on all future mailing lists.

MAIL ORDERS: PO Box 235, Northcote, Vic 3070. Min P & P \$1.00.

Ph: (03) 489 8131.

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070, MELBOURNE, VICTORIA. Ph (03) 489 8131. Telex No. 38897

Ideas for Experimenters

These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.

Square wave and pulse generator

This hobbyists' square wave and pulse generator can be built in a jiffy box and powered with a 9 V battery. It is meant as a clock, to power IC experiments.

With S1 to the right, square waves are generated in five overlapping ranges, each variable 10:1, via RV2. Total range is about 1 Hz to 100 kHz.

With S1 to the left, five fixed frequencies are generated: 10 Hz to 100 kHz, as selected by S2. The pulse width is variable in this mode. RV1 alters the duty cycle 1% through 99%, on the time-base of the frequency selected.

Table 1 shows the value of capacitors required, whilst table 2 shows the pulse widths available.

To test, connect an 8 ohm speaker in series with a 100R resistor and a 100 uF capacitor between the output and 0 V. Through the audio range it will squeal; when in the LF/short-pulse mode, it will click.

Quite a neat idea, from **Ron Mellor of Peakhurst, NSW.**

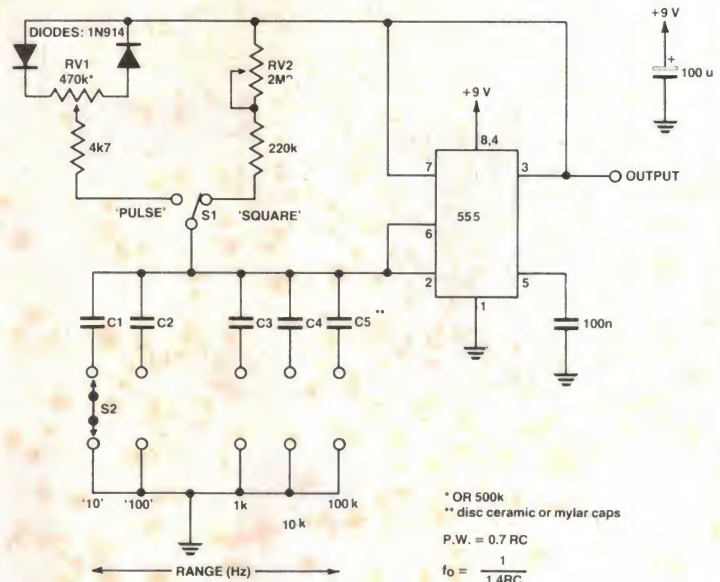


TABLE 1	
C1	330n
C2	33n
C3	3n3
C4	330p
C5	33p

TABLE 2	
RANGE (Hz)	PULSE WIDTH RANGE (RV1)
'10'	1 ms - 100 ms
'100'	100 us - 10 ms
'1k'	10 us - 1 ms
'10k'	1 us - 100 us
'100k'	100 ns - 10 us

* may not achieve

* OR 500k
** disc ceramic or mylar caps

P.W. = 0.7 RC

$f_o = \frac{1}{1.4RC}$

Auto-reverse for split-phase motors

The idea with this circuit, from **Kris McLean of Granville Tech. College NSW**, is to provide automatic reversing under load for an ordinary split-phase motor of the type used on drill presses and some garage door openers.

Resistor 'R' is chosen such that the relay is not energised so long that the start winding overheats, but is such a

value that the relay contacts do not drop out before the starting switch has opened, causing the motor to spontaneously reverse. A period of around half a second for R between 10k and 1M seems best.

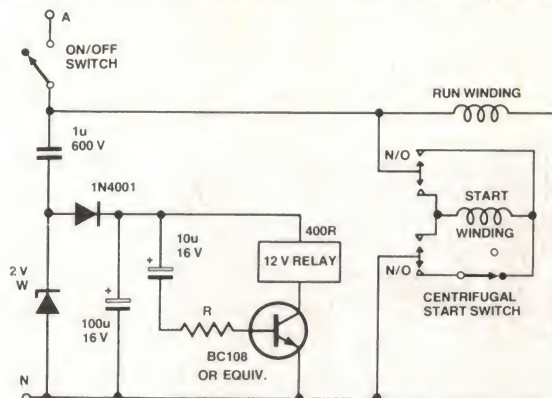
At switch-on the relay pulls in momentarily, the normally open contacts close briefly and give the motor a

start in the right direction. Shortly before reaching full rpm, the motor's internal starting switch opens and the relay drops out.

Now, when the motor loads up, the loss of rpm causes the centrifugal switch to close and thus reverses the motor.

The circuit's one disadvantage is that synchronous single-phase motors maintain their rpm under quite drastic loads and as such a reverse can only be initiated just prior to a stall condition. To get a more sensitive response involves altering the springs on the centrifugal starting switch.

Note that the relay contacts should be rated at 15 or 20 A.



ATTENTION

Double Density Computer Cassette Storage: This idea appeared on the bottom of page 57 of the February issue. It only works with decks that have a **split erase head**. Otherwise, when recording on one track, any recording on the other track will be erased.

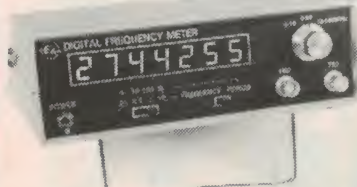
▲ BRILLIANT NEW KITS FOR '82! ▼

500MHz Digital Frequency Period Meter

REF: EA Dec '81 — Feb '82

500MHz option only \$26 extra

50MHz Version \$119



Tilting Bail to suit ONLY \$4.95

Other people may appear to be selling this kit for less. But you GET less!!! Exclusive Jaycar features:

- * Heavy gauge front panel. Pre-punched, and silkscreened. (NOT Scotchcal).
- * Low aging rate 10,000 MHz crystal
- * Quality IC sockets provided (A MUST)
- * All metal film resistors used (1% 50ppm)
- * Therm-alloy heatsink for +5V regulator

Beware of advertised units that do not conform to the original design. They may have inferior performance.

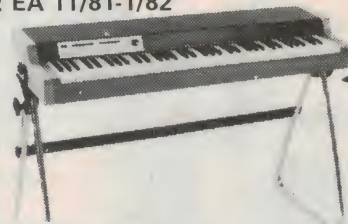
THE BEST QUALITY KIT VERSION OF THIS PROJECT IN AUSTRALIA

ONLY \$119

Lyrebird Piano Kit NEW LOW PRICE

0000

REF: EA 11/81-1/82



\$475

SAVE \$50!!!

NEW LOW PRICE!! Because we are shipping keyboards and other expensive components in bulk due to high demand, we can pass savings on to YOU.

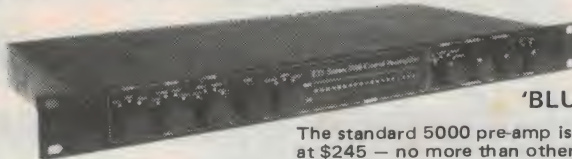
You can now have a magnificent "Lyrebird" 6 octave touch sensitive piano now for only \$475!! That's a staggering \$50 off the old price. REMEMBER!! THE LYREBIRD OUTPERFORMS READY BUILT PIANOS COSTING UP TO THOUSANDS OF DOLLARS MORE. WHY PAY MORE WHEN YOUR CONSTRUCTION KNOWLEDGE CAN SAVE YOU A FORTUNE?

Brilliant 5000 Series Amps — "NO COMPROMISE"



\$299

SUPERFINISH



\$275

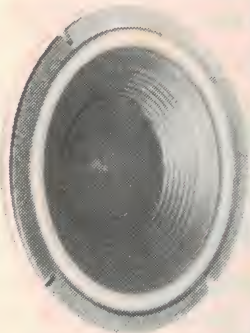
'BLUEPRINT'

The standard 5000 pre-amp is available at \$245 — no more than others but still better.

It is pleasing to see that many, many hundreds of Australians appreciate a quality kit when they see IT. The 5000 MOSFET P.A. and Pre-amp are so good they are attracting International interest. (We will be exporting our first shipment of these to - would you believe an Asian country - as you read this). Many people still can't comprehend their current performance specs make them the BEST amps in the WORLD.

WRITE FOR A FREE LEAFLET

Sub-Woofer Sensation



Many of you have followed the recent articles in EA regarding the design of vented loudspeaker enclosures. The natural progression of this discussion was a description of a vented speaker system. At the same time we were concerned that the most critical component, the low frequency driver must be of high quality with consistent Q_t and V_{as}. Jaycar has had such a speaker made! The unit has been specially manufactured for us to our specs. It is ideal for subwoofer applications based on the work of Thiele, Small and Snyder.

SPECS: Diameter 10" (250mm) cast frame * Q_t = 0.39 * V_{as} = 631 * Power Handling: 100W (RMS) * Voice Coil = 2" (51mm) dia. * Magnet Assy. = 3kg (6.6lbs).

Because of bulk buying we have been able to bring this unit to you at an unbelievable price. Normally this unit would sell for well over \$100 (they are overseas).

THE INTRODUCTORY PRICE FOR THIS UNIT? ONLY \$79.50 A FREE SUBWOOFER CABINET DESIGN IS PROVIDED WITH EACH UNIT!

ONLY \$79.50 ea

New EA FUZZ BOX \$19.50

Ref: EA Feb '81

COMPLETE KIT

The engineers at Jaycar have come up with a great version of this versatile kit. The kit features a heavy duty footswitch — a must for the serious stage muso.

ETI 158 LOW OHMS METER Ref: Nov '81 ETI \$29.50

This extremely handy kit is now available from US. Even capable of testing dry solder joints!! Complete kit inc. case & large meter.

Drum Synthesiser Kit

As used by WARREN CANN of "ULTRAVOX"



\$36.50

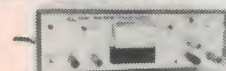
Original design from the UK magazine "Electronics and Music Maker" April 1981. Self-contained unit produces a variety of fixed and falling pitch effects. Trigger by tapping the unit itself or by striking a drum to which the unit is attached. The Jaycar "SYNTOM" comes complete with high quality pre-drilled moulded all ABS box 152 x 80 x 47mm with professional silk-screened front panel.

FEATURES: Decay from less than 0.1 second to several seconds, pitch control, sweep control and volume on/off.

EA dual tracking P/S

\$84.50

Ref: EA March '82



1% resistors used NOT 2%.

At last!! A dual-tracking power supply with fixed +5V reg. at a reasonable price!!

YOU PAY NO MORE FOR A QUALITY JAYCAR KIT!!

EXCLUSIVE!!
US-MADE
10 TURN .25%
LINEARITY POT
used for greater
accuracy

Jaycar

125 YORK ST SYDNEY 2000
Ph. 2646688 Telex 72293

Mail Orders To:

Box K-39 Haymarket 2000

Post and Packing charges

\$5-\$9.99 (\$1) \$10-\$24.99 (\$2)

\$25-\$49.99 (\$3) \$50-\$99.99 (\$4)

\$100 up (\$5.50)



SHOP HOURS

Mon-Fri 9 to 5.30

Sat 9 to 3

Sun 10 to 2

Thurs night to 8pm

UNDER \$1000
And just look at the features . . .

45MHz

Bright 15kV PDA tube

7.7nS risetime

Delayed timebase

See Review in Electronics Australia Feb 82

High 1mV/div sensitivity

Versatile triggering with indicators

Single shot

Ch A, Ch B, Add, Subtract, Dual, Chop, Alternate modes

Signal Delay

Such has been the popularity of the Aaron BS625 since its release that we have been able to arrange a bulk purchase and pass considerable savings on to you.

45MHz/1mV BS625 now \$990.00 ★

Popular BS601 20MHz/5mV with Component Tester



The 20MHz scope
with a
15MHz price tag
★ plus 17½% sales tax.

See review in
Electronics Australia
Sept 81
\$550.00 ★

PROFESSIONAL SCOPE PROBES AT HOBBYIST PRICES!

Coline SP100 scope probes to suit both these scopes and other popular brands provide 10MHz bandwidth in x1 position and 100MHz in x10. Complete with probe adaptors and in quality pouch.

SP100 probes \$25.00 each ★

AARON SCOPES FOR PROFESSIONALS

sold and serviced by

ELMEASCO

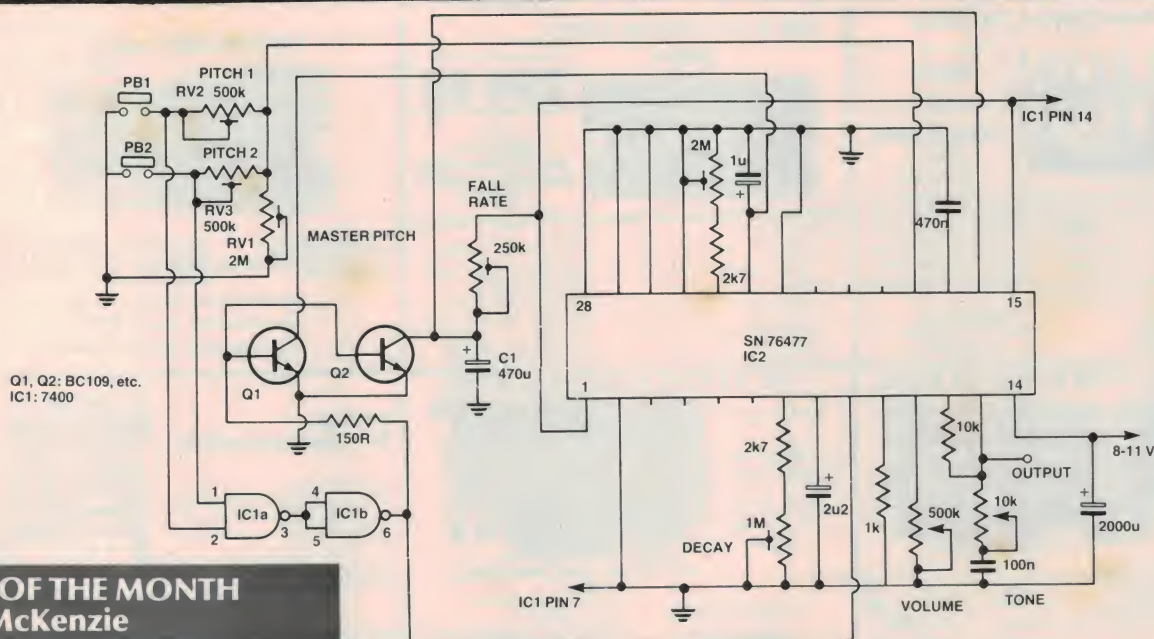
Instruments Pty. Ltd.

P.O. Box 30, Concord, NSW. 2137
13-15 McDonald St., Mortlake, NSW.
Phone: (02) 736-2888, Telex: 25887

P.O. Box 107, Mt. Waverley, Vic. 3149
21-23 Anthony Drive, Mt. Waverley, Vic.
Phone: (03) 233-4044, Telex: 36206

Adelaide: (08) 271-1839 Brisbane: (07) 229-3161 Perth: (09) 398-3362

Ideas for Experimenters



IDEA OF THE MONTH R.K. McKenzie

Simple drum synth.

'Electronic drums' are used by a number of pop groups, and this circuit will simulate the sounds produced by a drum synthesiser — but cheaply.

Commercial drum synthesisers use some sort of pressure-sensitive transducer for input — but they're next to impossible to make so I used pushbuttons instead. Keyswitches are another possibility.

The unit is built around the SN76477 Complex Sound Generator IC from

Texas Instruments (IC2). Capacitor C1 causes IC2 to produce a falling pitch as it charges, the rate being controlled by RV1. Q1 and Q2 ensure that the pitch will trigger at the same place when either button is pressed. IC2 contains a voltage-controlled oscillator which provides a square wave output at pin 13. As this can sound harsh, a tone control was added to give a similar sound to the commercial units.

Almost any transistors can be used

for Q1 and Q2, and a single AND gate from a 7408 could replace the two NAND gates from the 7400 (IC1).

Construction proved non-critical and any power supply from 8 to 11 volts (but **no higher** — Ed.) may be used as IC2 contains a 5 V regulator. The output is connected to an amplifier and RV1, RV2 and RV3 are adjusted to provide the pitches desired. The remaining potentiometers may be varied to achieve the desired sound.

★ 'IDEA OF THE MONTH' CONTEST ★

Scope Laboratories, who manufacture and distribute soldering irons and accessory tools, have offered to sponsor a contest with a prize to be given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI. Each month we will be giving away a Scope Panavise pc board holder, model 333 — as described in News Digest, p.8, October '81 issue. Selections will be made at the sole discretion of the editorial staff of ETI Magazine. Apart from the prize, worth about \$70, each winner will be paid \$10 for the item published. You must submit original ideas of circuits which have not previously been published. You may send as many entries as you wish.

RULES

This contest is open to all persons normally resident in Australia with the exception of members of the staff of Scope Laboratories, Murray Publishing, Offset Alpine, Australian Consolidated Press and/or associated companies.

Closing date for each issue is the last day of the month. Entries received within seven days of that date will be accepted if postmarked prior to and including the date of the last day of the month.

The winning entry will be judged by the Editor of ETI, whose decision will be final. No correspondence can be entered into regarding the decision.



Winner will be advised by telegram the same day the result is declared. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI.

Contestants must enter their names and address where indicated on each entry form. Photostats or clearly written copies will be accepted but if sending copies you must cut out and include with each entry the month and page number from the bottom of the page of the contest. In other words you can send in multiple entries but you will need extra copies of the magazine so that you send an original page number with each entry.

This contest is invalid in states where local laws prohibit entries.

Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.

COUPON

"I agree to the above terms and grant Electronics Today International all rights to publish my idea in ETI Magazine or other publications produced by them. I declare that the attached idea is my own original material, that it has not previously been published and that its publication does not violate any other copyright".

* Breach of copyright is now a criminal offence.

Title of idea

Signature

Name

Date

Address

Postcode

Cut out and send to: Scope/ETI 'Idea of the Month' Contest, ETI Magazine, 15 Boundary St, Rushcutters Bay NSW 2011.

64K \$89.50 STATIC NOW AVAILABLE \$399 + TAX
64K S100 STATIC NOW AVAILABLE \$399 + TAX

DON'T FORGET TO CHECK WITH US BEFORE YOU BUY A COMPUTER OR OTHER PRODUCTS

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070, MELBOURNE, VICTORIA

16K EPROM CARD-S 100 BUSS



**\$89.50
KIT**

BLANK PC BOARD
\$49
USES 2708's!

Thousands of personal and business systems around the world use this board with complete satisfaction. Puts 16K of software on line at **ALL TIMES!** Kit features a top quality soldermasked and silk-screened PC board and first run parts and sockets. Any number of EPROM locations may be disabled to avoid any memory conflicts. Fully buffered and has WAIT STATE capabilities.

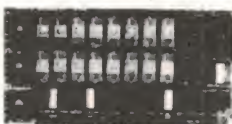
OUR 450 NS 2708'S
ARE \$5.90EA. WITH
PURCHASE OF KIT

ASSEMBLED
AND FULLY TESTED
ADD \$36

S100 COMPUTER PRODUCTS

32K S-100 EPROM CARD

NEW!



\$99.95

KIT
USES 2716's
Blank PC Board - \$59
ASSEMBLED & TESTED
ADD \$30

SPECIAL: 2716 EPROM's (450 NS) Are \$5.90 EA. With Above Kit.

- KIT FEATURES
1. Uses 2716's only 2716 (2Kx8) EPROM's
 2. Allows up to 32K of software on line!
 3. IEEE S-100 Compatible
 4. Addressable as two independent 16K blocks
 5. Cromemco extended or Northstar bank select
 6. On board wait state circuitry if needed
 7. Any of all EPROM locations can be disabled
 8. Double sided PC board solder-masked, silk-screened
 9. Gold plated contact fingers
 10. Unswitchable EPROM's automatically powered down for low power
 11. Fully buffered and bypassed
 12. Easy and quick to assemble

*** AVAILABLE AGAIN ***



- 16K Dynamic RAM Board
- Fully Expandable to 64K
- Assembled, tested and guaranteed
- S100 Compatible

16K Dynamic RAM Board assembled and tested: Special \$269 plus tax (4m Hz) \$289 plus tax (4mHz) This must be the best offer available on quality tested dynamic RAM boards.

32K Assembled and tested \$289 plus tax (4mHz)
48K Assembled and tested \$309 plus tax (4mHz)
64K Assembled and tested \$329 plus tax (4mHz)

16K STATIC RAM KIT-S 100 BUSS

KIT \$179
A&T \$199



KIT FEATURES

1. Addressable as four separate 4K Blocks
2. ON BOARD BANK SELECT circuitry (Cromemco Standard) Allows up to 512K on line!
3. Uses 2714 (450NS) 4K Static RAM's
4. ON BOARD SELECTABLE WAIT STATES
5. Double sided PC Board with solder mask and silk screened layout Gold plated contact fingers
6. All address and data lines fully buffered
7. Kit includes ALL parts and sockets
8. PHANTOM is jumpered to PIN 67
9. LOW POWER under 1.5 amps TYPICAL from the 5 Volt Bus
10. Blank PC Board can be populated as any multiple of 4K

BLANK PC BOARD W DATA \$55
LOW PROFILE SOCKET SET \$22
SUPPORT IC'S & CAPS \$29
ASSEMBLED & TESTED ADD \$30

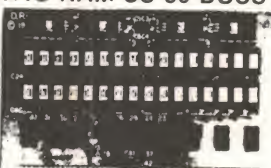
OUR #1 SELLING
RAM BOARD!

16K STATIC RAM SS-50 BUSS

PRICE CUT!

**\$199 KIT
A&T \$219**

FULLY STATIC
AT DYNAMIC
PRICES



32K STATIC ALSO AVAILABLE

- KIT FEATURES
1. Addressable on 16K Boundaries
 2. Uses 2114 Static RAM
 3. Runs at Full Speed
 4. Double sided PC Board Solder mask and silk screened layout Gold fingers
 5. All Parts and Sockets included
 6. Low Power Under 1.5 Amps Typical

BLANK PC BOARD - \$49 COMPLETE SOCKET SET - \$22 SUPPORT IC'S AND CAPS - \$45

ETI 660 THE \$99 COMPUTER!



FEATURES INCLUDE
Colour capability, operates from optional 9 V plugpack, 1K memory expandable to 3K on-board, single-board construction, cassette interface, audio output, simple to program (uses Chip-8)
Expansion projects coming up include ASCII keyboard, light pen, games software, etc.
Starter Kit (1K RAM, B&W Video) \$99.00
9 V 1 amp plug pack to suit \$12.50
Colour video option \$13.50
RAM Expansion (add to PCB) \$16.00

ETI636 7 SLOT MOTHERBOARD WITH ACTIVE TERMINATION Kit of Parts \$89.00. Assembled and tested \$115.00. inc tax.
RITRON COMPUTER GRADE POWER SUPPLY, +5V Reg. 10A. ± 16V Unreg. Kit of parts \$89.90 inc tax A&T \$109.00 inc tax
Write for list of other power supplies. Tax free prices also available.

SINGLE BOARD COMPUTER KIT NOW ONLY \$499 + TAX (17½%)

Also available: Blank PCB's with Roms \$275 + Tax.
Assembled & Tested \$599 + Tax.

THE FERGUSON PROJECT: Three years in the works, and maybe too good to be true. A tribute to hard headed, no compromise, high performance. American engineering! The Big Board gives you all the most needed computing features on one board at a very reasonable cost. The Big Board was designed from scratch to run the latest version of CP/M. Just imagine all the off-the-shelf software that can be run on the Big Board without any modifications needed! Take a Big Board, add a couple of 8 inch disc drives, power supply, and an enclosure, and you have a total Business System for about 1/3 the cost you might expect to pay

FEATURES: (Remember, all this on one board!)

64K RAM

Uses Industry standard 4116 RAM'S. All 64K is available to the user, our VIDEO and EPROM sections do not make holes in system RAM. Also, very special care was taken in the RAM array PC layout to eliminate potential noise and glitches.

Z-80 CPU

Running at 2.5 MHZ. Handles all 4116 RAM refresh and supports Mode 2 INTERRUPTS. Fully buffered and runs 8080 software

SERIAL I/O (OPTIONAL)

Full 2 channels using the Z80 SIO and the SMC 8116 Baud Rate Generator. FULL RS232! For synchronous or asynchronous communication. In synchronous mode, the clocks can be transmitted or received by a modem. Both channels can be set up for either data-communication or data-terminals. Supports mode 2 Int. Price for all parts and connectors: **\$65**

BASIC I/O

Consists of a separate parallel port (Z80 PIO) for use with an ASCII encoded keyboard for input. Output would be on the 80 x 24 Video Display.

REAL TIME CLOCK (OPTIONAL)

Uses Z-80 CTC. Can be configured as a Counter on Real Time Clock. Set of all parts: **\$19**

24 x 80 CHARACTER VIDEO

With a crisp, flicker-free display that looks extremely sharp even on small monitors. Hardware scroll and full cursor control. Composite video or split video and sync. Character set is supplied on a 2716 style ROM, making customized fonts easy. Sync pulses can be any desired length or polarity. Video may be inverted or true.

FLOPPY DISC CONTROLLER

Uses WD1771 controller chip with a TTL Data Separator for enhanced reliability. IBM 3740 compatible. Supports up to four 8 inch disc drives. Directly compatible with standard Shugart drives such as the SA800 or SA801. Drives can be configured for remote AC off-on. Runs CP/M 2.2.

FOUR PORT PARALLEL I/O (OPTIONAL)

Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. User selectable hand shake polarity. Set of all parts and connectors for parallel I/O: **\$29**

PFM 3.0 2K SYSTEM MONITOR

The real power of the Big Board lies in its PFM 3.0 on board monitor. PFM commands include: Dump Memory, Boot CP/M, Copy, Examine, Fill Memory, Test Memory, Go To, Read and Write I/O Ports, Disc Read (Drive, Track, Sector), and Search. PFM occupies one of the four 2716 EPROM locations provided. It does not occupy any of the 64K of system RAM!

Please debit my Bankcard
Bankcard No. _____
Expiry Date _____
Name _____
Signature _____

General enquiries (03) 489-8131. Mail order enquiries (03) 481-1436. Ritronics Wholesale (03) 489-7099. (Tax Exempt Enquiries)

Prices subject to change without notice. Send 60¢ and SAE for free Price lists. MAIL ORDERS PO BOX 235, NORTHCOTE, Vic. 3070. Minimum pack and post \$5.00. Telex AA38897. PLEASE WRITE OR RING FOR THE BEST POSSIBLE PRICES ON DISC DRIVES, PRINTERS AND OTHER COMPUTER COMPONENTS.

DEVELOPING MICROSYSTEMS?



NOW
AVAILABLE
IN
AUSTRALIA

2716

2732

2532

Etc.



INTELLIGENT STAND ALONE EPROM PROGRAMMER ROMULATOR

- MONITOR or TV output (625 line UHF). Data contents of memory visible — A WINDOW IN THE CHIP.
- 28-KEY, 2-LEVEL KEYPAD with HEX ENTRY and EDITING CAPABILITY (BYTES and BLOCKS of code can be changed, inserted, deleted, shifted around etc.)
- INPUT and OUTPUT: SERIAL (RS232) and PARALLEL (Centronics) routines provide ready interface with computer or printer.
- EMULATION of PROGRAM MEMORY in-circuit is performed by plugging SOFTY into the ROM SOCKET. A lead with a 24 pin DIL PLUS is supplied.
- CASSETTE INTERFACE.
- EPROM-PROGRAMMER: an EPROM may be copied or reprogrammed at the press of a key.
- PERSONALITY SWITCH selects 2716, 2532, 2732.

SOFTY is used as an EPROM-PROGRAMMER, a production ROM CHECKER and for the DEVELOPMENT and PRODUCTION OF PRODUCTS which contain MICROPROCESSORS and use EPROM for program storage.

Price \$379.00 + Sales Tax 17.5%

Free delivery in Australia, Built & Tested. Incl. Power Supply, TV lead, Romulator lead, 90 day warranty. Allow up to 21 days for delivery. Exclusive Agents

Castle

ELECTRONICS

P.O. Box 311 Castle Hill N.S.W. 2154
PH (02) 634 7597. S.A.E. for more information



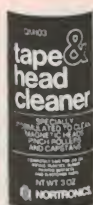
NORTRONICS AUDIO & DIGITAL TAPE HEADS



for long life extended response

- Replacement heads for cassette decks, reel to reel decks, cartridges and cassette recorders. Also professional recorders and duplicators.
- Will fit AMPEX, SCULLY, TEAC, ATC, GATES, PENTAGON and many more.
- Specification sheet of all Nortronics heads available on request.
- Complete range of Alignment tapes for cassette, reel to reel and cartridge decks.
- REGULAR MAINTENANCE ENSURES CONTINUED OPTIMUM PERFORMANCE. Nortronics manufactures a full range of audio care products.

TAPE
HEAD
CLEANER



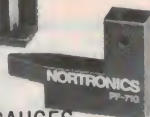
ALIGNMENT
TAPES



SPlicing
BLOCKS



SPlicing TABS



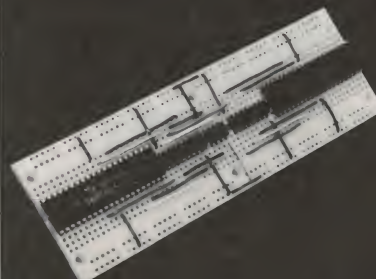
ZENITH/HEIGHT GAUGES

- NORTRONICS audio care products are designed to care for and maintain your valuable recording equipment.
- SEND TWO 22c STAMPS FOR OUR FREE BROCHURE ON THE COMPLETE NORTRONICS ACCESSORIES RANGE.

E.I. EMAC INDUSTRIES Pty. Ltd.

2 Bengal Crescent, Mount Waverley,
Vic. 3149. Ph: (03) 277-9989.

Solderless Breadboarding Sockets



... enable you to insert your electronic components directly — without soldering irons or adapters.

Go from conception to working circuit in minutes.

The highest quality socket in the industry now carries a lifetime guarantee. Should the SK 10 ever break, be damaged or fail to perform as described, return it for a free replacement. No questions asked.

We can offer such a guarantee because the SK 10 is a top quality socket built tough for years of use. Integrated circuits and discrete components insert directly without adapters. No patch cords needed. And of course, no soldering.



**ELECTRONIC
DEVELOPMENT SALES
PTY LIMITED**

92 CHANDOS STREET, ST. LEONARDS
P.O. BOX 217 ST. LEONARDS, N.S.W. 2065
AUSTRALIA
TELEPHONE: 438 2500 438 2412
TELEX AA 25963

DISTRIBUTORS

N.S.W.: DGE SYSTEMS
103 Broadmeadow Road, Broadmeadow
Phone: (049) 69 1625
MACELEC ELECTRONIC
99 Kenny Street, Wollongong 2500
Phone: (042) 29 1455
A.C.T.: ORTEX PTY LTD
5B Cumberland Court, Wollongong Street, Fyshwick 2609
Phone: (062) 82 4995
VIC: STEWART ELECTRONIC COMPONENTS PTY LTD
44 Stafford Street, Huntingdale 3166
Phone: (03) 543 3733
S.A.: GRAPHIC ELECTRONIC INDUSTRIES PTY LTD
41A Rundle Street, Kent Town, 5067
Phone: (08) 42 6655
W.A.: RESERVE ELECTRONICS
5 Bookham Street, Morley 6062
Phone: (09) 275 2377
QLD: FRED HOE & SONS PTY LTD
246 Evans Road, Salisbury North 4107
Phone: (07) 277 4311

Go AWA digital for \$98

Plus sales tax
where applicable



AWA brings you a high quality Digital Multimeter with all these features:-

- 3.5 digit LCD display with 'auto' polarity indication.
- 30 measuring ranges. Resistance to 0.1Ω. Minimum current range 200μA (resolution 0.1μA).
- Built in transistor tester.
- Continuity tester.
- Basic accuracy 0.5%.

And with the DM-500 you get AWA knowhow and support. At \$98.00 (plus sales tax), the DM-500 offers unusually high performance and value for money. Call your nearest AWA office for information.

The price includes a protective carrying case



AWA Limited
North Ryde Division
422, Lane Cove Road, North
Ryde NSW 2113 Telex 20623
(02) 887 7111.

Interstate Offices:- (03)529 4133,
(07)36 1277, (08)42 6666,
(09)325 5722, (003)44 5155,
(077)79 6155



56 - April 1982 ETI

Shoparound

THIS PAGE is to assist readers in the continual search for components, kits and printed circuit boards for ETI projects. If you are looking for a particular component or project — check with our advertisers if it is not mentioned here.

ETI-645 Turtle Robot

A complete kit of parts for this project is being offered at a special introductory price by Flexible Systems, and ETI is acting as a clearing house for orders and despatching kits; see page 37 for further details. You can call into our Sydney or Melbourne offices during business hours to see a Tasman Turtle and purchase kits. In Sydney, you'll find us at:

4th Floor, 15 Boundary St,
Rushcutters Bay.

In Melbourne, at:
22nd Floor, 150 Lonsdale St,
Melbourne.

Note that 'Tasman Turtle' is a registered trademark of Flexible Systems.

ETI-469 Percussion synth.

This project will be widely stocked by kit suppliers. Most components are readily obtainable so constructors should have little difficulty assembling parts. The case we used is Model No. EC.1002 from Sigea in Melbourne. Some kit suppliers have indicated they will have these available. To find your nearest supplier or for further information, contact Sigea at P.O. Box 49, Thornbury Vic. 3071. (03)481-1422.

The knobs we used are a simple 'slip-on' type that fit the standard pot shaft with a 'flat'. They are obtainable with a variety of coloured pointer caps that



A very handy range of small heatsinks, manufactured by 'Heatsinks Plus' is available from Stewart Electronics, 44 Stafford St, Huntingdale 3166. The range includes types that can be mounted direct on DIL package ICs, TO3 case devices, TO220, TO229 and TO365-6 devices.

make for easy identification of the controls — almost essential with this project! Ours were supplied by Jaycar, 125 York St, Sydney. Cost — about 60¢. Collect knobs with colour-coded caps are also ideal for this project, though more expensive.

Scotchcal panels and pc boards are obtainable from the usual suppliers — see page 60 in the March issue.

The 250k linear pots are not usually a 'stock' line, but should be readily obtainable from most component suppliers by the time this issue goes on sale.

NEW, MOLDABLE PLASTIC

COAX-SEAL[®]

Seals coax fittings from moisture and corrosion

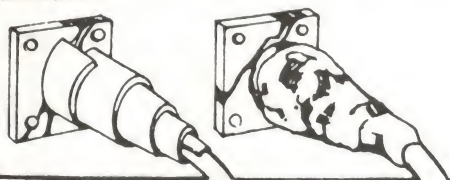
- Only material that will adhere to poly vinyl or vinyl outer coax jackets.
- Forms and seals over odd shaped and difficult fittings
- Non-contaminating and non-conductive.
- Wide ambient temperature range (-30°F to +180°F).
- Stays flexible for years thus insuring moisture proof connections.
- Reusable - allows you to quickly disconnect fittings and reseal them with the same material.
- A must for satellite TV-microwave work - wire antenna at solder joints-in the shack.

Packaged in convenient 1/2" x 60" roll.

\$4 per roll P. & P. \$1

DEALER
INQUIRIES WELCOME

COAX-SEAL[®]... the new space age material that is quick and simple to apply. Remove backing from approximately 6" of plastic. Wrap outer covering toward fitting. After wrapping, knead to form a smooth surface and force out air. EFFECTIVE - FOOL PROOF - INEXPENSIVE.



Hy-Tech Distributors,
Building 51, Archerfield Aerodrome, Qld., 4108
Telephone: (07) 277 5624.

JAYCAR KITS → QUALITY RESULTS

DIGITAL CAPACITANCE METER * * *

Ref: EA March 1982

This kit once again uses the amazing DPM 200 LCD display/driver module (see below). Capable of measuring capacitance from 1pF to 19.99uF it is a must in every workshop or lab.

Kit includes case.

Only
\$59



Digital Thermometer EA2/82

Ref: EA Feb 1982

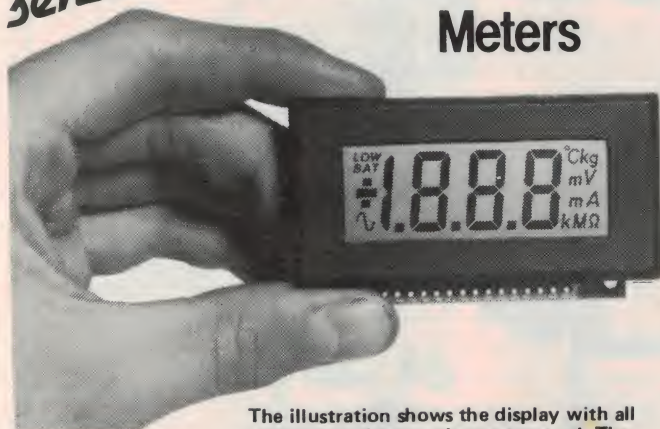
Read the temperature in your room (or outside) from 0 degrees C to 100 degrees C in fact to within 0.1 degree C. Fantastic resolution on a bright easy-to-read display.

only
\$59

INC CASE



sensational LCD Panel Meters



The illustration shows the display with all segments and annunciators actuated. The unit is housed in a neat plastic escutcheon. The DPM measures 72x36mm overall. Digital height - 15mm (can be read at distances up to 10 metres). Specs:

Input impedance: >100m
Full scale reading: 199.9mV
Accuracy 0.05% of reading ±1 digit
Power supply: 5-15VDC 50uA
Sample rate: 3/sec
Auto polarity, auto zero, over-range warning

DPM-200
ONLY

\$39.50

case to suit \$5.50 Full data sheet supplied with each unit.

CUDLIPP CRICKET

Ref: EA
Feb 1982

One of the most popular kits ever produced by Jaycar. Cudlipp chirps back to you when you talk. Talk about frustrating! Great fun to hide in someones desk!!

The Jaycar kit comes exclusively with 8 great big colourful 2 watt carbon resistors that you use as legs. Great fun for only

\$12.50



vocal canceller * Ref: EA April 1982

This project enables you to cancel out a singers voice on a record so that you can insert your own.

BE A STAR FOR ONLY **\$19.50**

Function Generator

Ref: EA April 1982

"Pigeon Pair" companion to the new 500MHz DFM. Low distortion generator of sine, square and triangular waveforms. From below 20Hz to over 160kHz. Inbuilt 4 digit frequency counter in de-luxe Pac-Tec case. Only \$85

JAYCAR EXCLUSIVE - 1% 50ppm metal film resistors used for stability and it's still only \$85!!!

only
\$85



Digital Storage CRO Adaptor

Ref: Feb 1982 EA

Not only can you avoid buying an expensive CRO but you can have the features of the REALLY expensive ones!!!

- Can display very slow waveforms
- One shot triggering
- Inbuilt graticle shows on TV screen
- Crystal locked timebase
- DC-100kHz bandwidth
- capable of storage operation

Staggering value at \$110.

\$110



SOUND BENDER

\$34.50

ETI REF: FEB 1982

Jaycar has taken this kit and added a smart all ABS plastic cabinet with specially silk-screened lid. This is the full kit.

If you have a case yourself then the short-form kit is only \$24.50!! - Includes all parts (less case).



EXCLUSIVE!!! Special heavy duty EXTRUDED heatsink bracket.

150W MOSFET AMP KIT *

Ref: ETI March 1982

At last high power, with the stability and inherent safety of MOSFETS.

Genuine 150W RMS with power supply on the PCB!! You only need to connect the power tranny and Philips 65D heatsink!!

PF4361/1 transformer \$39.50

65D heatsink, drilled, tapped & black anodised \$39.50

ETI MODULE ONLY **\$79.50**



Jaycar

!!! NEW ADDRESS !!!
125 YORK ST SYDNEY 2000
Ph. 2646688 Telex 72293



SHOP HOURS
Mon-Fri 9 to 5.30
Sat 9 to 3
Sun 10 to 2
Thurs night to 8pm

Mail Orders To:
Box K-39 Haymarket 2000
Post and Packing charges
\$5-\$9.99 (\$1) \$10-\$24.99 (\$2)
\$25-\$49.99 (\$3) \$50-\$99.99 (\$4)
\$100 up (\$5.50)

**STOP
PRESS
SPECIAL**

Budget Busters!

NEW TOROIDAL TRANSFORMERS

40V 1.2AMPS
PLUS 15V 200mA
Made in Sweden by TRANSDUKTOR
These high-efficiency Toroidal Transformers are only 80mm diam. x 33mm high. Regular price \$42.00

\$21

NEW PLESSEY EDGE CONNECTOR

WITH 80XGOLD-PLATED CONTACTS AT 0.156" PITCH, YOU CAN FULFILL ALL YOUR EDGE CONNECTOR NEEDS- YOU CUT THEM TO LENGTH!

ONLY \$1

TRANSFORMERS

MAINS 120V PRIMARY
2 IN SERIES FOR 240V
12V 1A EACH
2 for \$2

MAIL ORDERS: ADD \$1 EXTRA PER PAIR

CO-AXIAL SWITCH

SPDT rotary-action switch for HF/VHF use.
\$19

CRYSTAL CARTRIDGES

85c each
MONO STEREO

CAPACITORS "GOING CHEAP"

25,000uF .5v..\$2.50
8,000uF .10v..\$2.50
50,000uF .12v..\$4.00
7,000uF .15v..\$3.50
55,000uF .15v..\$7.00
5,000uF .20v..\$3.50
22,000uF .20v..\$7.00
90,000uF .20v..\$9.00
10,000uF .25v..\$4.00
18,000uF .25v..\$6.00
30,000uF .25v..\$7.00
48,000uF .25v..\$8.00
80,000uF .25v..\$9.50
4,000uF .30v..\$3.50
19,000uF .30v..\$6.00
33,000uF .30v..\$7.50
56,000uF .30v..\$8.50
3,000uF .75v..\$3.00
4,800uF .40v..\$3.50
12,000uF .40v..\$6.00
3,500uF .45v..\$4.00
11,000uF .45v..\$6.50
24,000uF .45v..\$8.00
46,000uF .45v..\$10.50
4,600uF .50v..\$6.00
12,400uF .50v..\$8.50
5,000uF .63v..\$6.50
13,000uF .63v..\$9.00
18,000uF .63v..\$10.00
5,500uF .75v..\$5.00
11,000uF .75v..\$8.00
30,000uF .75v..\$11.00
2,500uF 100v..\$3.50
6,800uF 100v..\$6.00
13,000uF 100v..\$11.50
2,200uF 150v..\$5.00
3,500uF 150v..\$7.50
1,800uF 200v..\$6.00
4,800uF 250v..\$11.00
OIL-FILLED PAPER
4uF...660VAC \$3.00
6.5uF...600VAC \$4.00
8uF...330VAC \$4.00
10uF...660VAC \$5.00

FULLY
GTEED
TESTED

LOW
COST

STEREO BOOSTERS

REGULAR PRICE \$69
NOW YOU SAVE \$14

\$55 25Wx2
LED BAR-GRAPH
POPULAR MODEL

DC MOTORS

6-12V
LARGE SIZE!
IDEAL FOR TOYS,
MODEL BOATS,
CARS, HOBBY ETC.
OPERATES FROM 4.5V
TO 12V. POWERFULL
AND RUGGED. SIZE
47MM DIAM X 60MM
\$3 ea
10 for \$25

10KgM SURPRISE KIT

LOTS OF HANDY HOBBY-PARTS!
Motors
Resistors
Capacitors
Semiconductors
Samples, etc etc.
\$9.95
INTER-STATE POST- ADD \$3.00

Save on Hi-Fi SPEAKERS

8 INCH 25WATT
3 WAY 25 RMS
PAIR ONLY

\$89

DON'T PAY UP TO \$159 OR MORE FOR 8 INCH 3 WAY SPEAKERS! THESE FACTORY-MADE SPEAKERS ARE IN BEAUTIFUL WALNUT WITH BLACK CLOTH, 8 OHMS

Tape heads

High quality, low cost
REC/PLAY tape heads
for replacement in most
cassette recorders. Suits Vortex
mechanism, etc.
MONO HEADS
\$2.99 EA
\$10

ECONOMY FM MIC

88-108Mhz
Transmits to 50m
range, condenser
microphone.
Normally \$14
\$10

12 VOLT SIEMENS CRADLE RELAYS

Double pole on-off contacts normally open
Regular price is over \$4.00 for this quality!

MINI RELAYS

EA. **\$1.49**
240V AC coil
HEAVY DUTY
10A CONTACTS
4 CHANGEOVER
Great value,
worth over \$5
hugely purchase
enables us to sell for
less than HALF!
Buy 10+, \$2.25

STOP THIEF!

Ultra-sonic
BURGLAR ALARM **\$39**
WAS \$65, NOW SAVE \$16
Ideal for your home, office or shop, the General Electric ultra-sonic alarm is small, self-contained and inconspicuous. The beam detects at up to 30ft, and emits a very loud, shrill tone which can be heard for over 100 metres. A 5-digit push-button selector cuts off the alarm which resets after 5 mins, and a 35second test and exit delay and instant "ON" or delay "ON" (10secs) are included.

ASTOUNDING APRIL SAVINGS!

12V DC ROTARY SOLENOID STEPPING SWITCH

12 POSITION, SINGLE POLE, SHORTING.
\$19.99

IC's "SWEEPINGS OFF THE FACTORY FLOOR"

Approx 100 ASST. FOR **\$11.50** 1000 for **\$11.50**

THE COOLERS

SQUIRREL-CAGE FANS
SINGLE OUTLET
115V OR 220V AC
\$14 **\$20**

DUAL BLOWERS

"BLOW-ME-DOWN"
These high-volume coolers are for really heavy-duty use!
\$24 115V OR 230V

HEATSINKS

HUGE RANGE AVAILABLE!
3"x4" with 1xT03 TRANS. \$2.50
6"x4" with 2xT03 TRANS. \$3.00
9"x4" with 4xT03 TRANS. \$4.00
3"x4", 3x100piv 35A RECT. \$2
VARIETY PACK- 10 ASSORTED HI-QUALITY HEATSINKS WITH SCR'S, RECTIFIERS AND TRANSISTORS. IDEAL FOR EXPERIMENTERS \$9.95
ONLY WHILE THEY LAST! WOW!

PARTY STROBE

BRAND NEW FACTORY WARRANTY
NORMAL PRICE \$29.95
SAVE NEARLY \$5
"Freeze" the action at your next party or theatrical show! Mains operated with a continually variable flash rate, housed in an attractive black vinyl box 150mm
\$25

SPEAKER BOX SELLOUT! AT PUNCHBOWL

EACH **\$6**
620mm X 350mm X 225mm Deep
Walnut finish, fully assembled, with back panel. No Mail-Order!

NUMERIC KEYPADS

\$2.50
Famous German "Raf" maker
Computer quality switch
11 keys 18x18mm, long life, for PCB mtg.

CLEARANCE SALE

CB XTALS 27.880, 27.890, 27.900, 27.910...pr\$1.50
TTL 7406.....10for\$2.00
TTL 7420.....10for\$1.50
TTL 7473.....10for\$4.00
TTL 7490.....10for\$4.50
5mm Red LEDs...10for 0.90
5mm Bezel for LED...ea0.05
3AG Fuseholders- in-line plastic.....10for\$2.00
PCB Fuse-Clips.8for 0.50
Philips 2"8uWweeters 20W power.....2 for\$4.00
4" Mid-range 8u20W power, imported Novik ea.\$4.00
6"x4", 4"sq. 15A...ea.\$3.00
Record Cleaner Arm, with cleaning kit...ea.\$2.00
12V 100mA mini-globes, wire leads...10for\$1.00
Neons NE-2 90v 8for\$1.00
DPDT slide switch...ea0.25
DP3T slide switch...ea0.30
DPST rocker " "ea0.30
3 pos 10Amp rotary sw. with white knob...ea0.50
4 pos Oak rotary switch, with On-Off...ea0.50
0.1uF 250v poly 12for \$1
0.22uF 100v " 10for \$1
0.015uF 200v " 15for \$1
0.068uF 400v " 10for \$1
0.047uF 200v " 10for \$1
0.022uF 200v " 12for \$1
0.15uF 250v " 10for \$1
0.68uF 260v " 4 for \$1
0.056uF 1KV " 3 for \$1
0.47uF 400v " 4 for \$1
0.1uF ceramic 12for \$1
0.047uF ceramic 15for \$1
1000pF ceramic 20for \$1
100pF 25v styro 20for \$1
15uF 35v tantalum ea0.30

NEW PACK AND POST CHARGES: BASIC \$2.00 PLUS 5% OF ORDER VALUE. We still subsidise many of the orders, as over 500gm postal charges are \$3.60 to some states, up to \$6.60 over 10Kg. We believe this is a fairer system for all

G.I.S. ELECTRONICS
750-2651

1190 CANTERBURY RD,
PUNCHBOWL 2196
NEAR ROSELANDS SHOPPING CENTRE

PRE-PAK electronics

SHOP: 1A WEST ST.
LEWISMAN NSW
MAIL: P.O. BOX 43,
CROYDON NSW 2132

569-9797
Pack/Post: See above.

LETTERS

Dear Sir,

I have been a regular reader of your magazine since it was first published, and have generally preferred your style of presentation to that of your competitors, both here and abroad; however, I have been very disturbed the last few months, by an idiosyncrasy of spelling — namely your use of the double-s in 'buss', which I confess has a similar effect on me to that of hearing car salesmen (and others) talk about 'kill-ommitters'.

The derivation of the word is quite clear-cut — from the Latin 'omnibus' (ablative pl. of omnes) meaning 'for all', applied originally to a horse-drawn vehicle which anybody could ride on for a fee, and later contracted to 'bus' after the motor-omnibus had taken over from the horses. By analogy it was then applied to a heavy conductor, known as a bus-bar, to which large numbers of machines could be connected as a source of power. Later, with the advent of computers, it was used for the much lighter parallel groups of conductors used to carry small signals to various parts of the machine, but still with the same basic concept of being something each device could, as it were, 'jump onto' as necessary.

'Buss' on the other hand is an old word much used by Shakespeare, meaning a kiss — quite a different idea, I'm sure you will agree. To support me in this distinction I would refer you to:

The Concise Oxford Dictionary
The Macquarrie Dictionary
The Random House Dictionary
A Dictionary of Electronics, S. Handel, Penguin
A Dictionary of Computers, A. Chandor et al, Penguin

The only one of the above to give 'buss' as a possible alternative for 'bus' is the Random House (American), and then *only* for its 'meaning 1' (i.e. a motor vehicle).

I had seen very occasional references in advertisements (American) to 'S100 Buss' but had put them down to ignorance, until suddenly, some time in 1981, it dawned on me that you had adopted a policy of using that spelling — either that or your 'Spellguard' had accidentally got misprogrammed! I hope you will tell me the latter is the case, but if it is a new policy I would be interested to hear the reasons, and also whether you have had any other letters of protest? It is apparent that at least some of your contributors prefer the traditional spelling as shown for

instance on page 103 of the October issue, where 'BUS' appears on the pc board for the Learner's Microcomputer, ETI-660, although it has been altered to 'buss' in the text of the article!

I was going to remind you how many millions of pounds the British Post Office had saved on printing ink by leaving out the full-stops after 'Rd.', 'St.', etc, in their telephone directories, but after what you have told us about the silver on the November cover that might seem like a fleabite!

Peter J. Frost
Albany W.A.

P.S. Should you decide to publish this letter, don't forget to disable your Spellguard, or it may not make much sense!

Thanks for the opening praise, but we just knew it preceded a gripe! Well, I guess we should make some song-and-dance about our 'special' words — buss isn't the only one!

For a start, we can dismiss American meanings or interpretations for 'buss'. ETI is not distributed in America (though we do have a few subscribers on the North American continent . . .). We are aware of the meaning of buss as in kiss pertinent to Shakespearean times. To all our 380-year-old readers, we apologise for confusing you . . . There is a more risqué meaning, but we won't go into that!

We started using the word 'buss' in computer material in ETI during the latter half of 1980. In retrospect, we should have made a 'big deal' of it. The word was adopted in order to distinguish between buses/busses, as much computer material mentioned supply buses and interface/communications busses in juxtaposition without clearly distinguishing which was which. In addition, outside the computer world, the word 'bus' is well understood and generally refers to a supply rail. In computer parlance it usually refers to a group of lines, which generally carry signals. All right, we're out on a limb so far as usage is concerned (. . . who said 'trendies'?), but the change is partly for our sake as well as readers'.

Mind you, 'buss' is not universally accepted amongst staff and correspondents. Graeme Teesdale had his protest engraved forever on the ETI-660 Learners' Microcomputer pc board! (As you noticed.)

Secondly, at the risk of disturbing you further, did you spot 'disk' and 'disc', 'program' and 'programme'? In computer material you will see floppy disks and hard disks; in other areas 'disc' is used. When referring to computer software we use 'program', whereas a list or schedule of events, etc, we refer to as a 'programme', as defined by the dictionary.

All you Babelo-linguistic critics — stay your quills and rest your tablets as we now bring ETI's Production Editor, Jane Clarke B.A. (Hons.) to the front line. (Only correspondence from Ph.D.s will be accepted . . . not published, just accepted.)

R.H.

Well now, bus or buss is all Greek to me — far too technical — but I couldn't resist pointing out a few quibbles that occurred to me on reading Mr Frost's letter. Firstly, 'omnibus' as translated 'for all' is dative, not ablative, plural; the construction is exactly the same, but if we're splitting hairs . . . As for kilometres, it seems to me they were always pronounced as Mr Frost dislikes until metrication was forced upon us, at which point the Metric Conversion Board stepped in and foisted the inelegant 'killo-meters' onto us. To quote their estimable booklet 'Metric Conversion for Australia' (just what we always wanted): "KILO: Used as a prefix with any unit, the pronunciation should be 'kill-o-' with the accent on the first syllable and 'o' pronounced as in 'oh'. To place the accent on the 'o' or the pronounce the 'o' as in 'tot' is incorrect . . .". Now, with all respect to the Metric Conversion Board and the doubtless logic behind their decree, English has never been a language to succumb well to logic and is best left to find its own level, so to speak, in matters of pronunciation. I for one will stick to 'kill-ommitters' (and to 'controversy', however often the ABC offends me with 'controversy') as the far more elegant form; come to that, if we'd stuck to miles and feet and inches in the first place there'd be no controversy.

Incidentally, we don't have Spellguard on our typesetter; all spelling errors in this magazine are likely to be mine! However, I should like to point out to other readers that the rendition of 'Macquarrie' with double-r in Mr Frost's letter is his own invention entirely, and was left in by us only to show that however erudite, nobody's perfect.

J.C.

Take everything—but not my Babani Books!!!

REACTANCE/FREQUENCY CHART FOR AUDIO AND RF.

Enables the reactance of any capacitor or resistor to be read off immediately — from 10 Hz to 100 MHz. Resonant frequencies of LC networks ditto.

196 95¢

PRACTICAL TRANSISTORISED NOVELTIES FOR HI-FI

Circuits for audio power meter, stereo phone adaptor, multi-channel mixers, gain control, contour network etc. etc.

201 \$1.30

HI-FI LOUDSPEAKER ENCLOSURES

Data for building corner reflex, bass reflex, exponential horn, folded horn, tuned port, Klipschorn labyrinth, tuned column, loaded port and multi speaker panoramics. Clear dimensioned diagrams included.

205 \$3.20

DIODE CHARACTERISTICS, EQUIVALENTS & SUBSTITUTES

Includes signal, zener, rectifier diodes etc. Full interchangeability data and characteristics of thousands of diodes of all types with every possible alternative. Includes UK, USA, European, Russian, and Far Eastern devices.

211 \$4.20

AUDIO ENTHUSIASTS' HANDBOOK

Discusses audio and hi-fi topics including record/playback curves, stylus compliance, disc recordings — then and now, evaluating loudness, equipment compatibility, acoustic feedback, equipment performance figures and standards etc. etc.

214 \$2.90

BUILD YOUR OWN ELECTRONIC EXPERIMENTERS' LAB USING ICs.

Includes many circuits and designs for constructing test and measuring instruments mostly using modern ICs. Includes AF osc, IITL pulse detector, hi-impedance Vm, square-wave osc/pulse gen, logic probe, lo-range ohmmeter, bridge, signal tracer etc.

218 \$2.90

SOLID STATE NOVELTY PROJECTS

A number of novelty projects using modern ICs and transistors. Includes 'Optomin' — a musical instrument played by reflecting a light beam with your hand, water warbler for pot plants, music tone generator, LEDs and ladders game, touch switch, electronic roulette wheel etc.

219 \$2.90

BUILD YOUR OWN HI-FI & AUDIO ACCESSORIES

Essential for keen hi-fi and audio enthusiasts. Projects include stereo decoder, three-channel mixer, FET preamp for ceramic pick-ups, mic preamp with adj. bass, stereo dynamic noise limiter, loudspeaker protector, voice-operated relay, etc.

220 \$2.90

28 TESTED TRANSISTOR PROJECTS

Some circuits are new, others are familiar designs. Projects can be split and/or combined for specialised needs.

221 \$4.20

SOLID STATE SHORT WAVE RECEIVERS FOR BEGINNERS

Design and construction of several solid-state short-wave receivers giving high level of performance yet utilising relatively few inexpensive components. See also 226.

222 \$4.20

50 PROJECTS USING CA 3130 ICs.

The CA3130 is an advanced operational amplifier capable of higher performance than many others: circuits often need fewer ancillary components. Interesting and useful projects in five groups. Audio projects. RF projects. Test equipment. Household projects. Misc. projects.

223 \$4.20

50 CMOS PROJECTS

Many interesting and useful projects — multivibrators, amplifiers and oscillators; trigger devices; special devices.

224 \$4.20

PRACTICAL INTRO TO DIGITAL ICs

Introduction to digital ICs (mainly TTL 7400). Besides simple projects, includes logic test set to identify and test digital ICs. Also includes digital counter-timer.

225 \$4.20

HOW TO BUILD ADVANCED SHORT WAVE RECEIVERS

Full practical constructional details of receivers with performance equal to commercial units. Also 'add-on' circuits of Q meter, S meter, noise limiter etc.

226 \$4.05

BEGINNERS' GUIDE TO BUILDING ELECTRONIC PROJECTS

Enables total beginners to tackle electronic projects. Includes component identification, tools, soldering, building methods, cases, legends etc. etc. Practical basic projects are included.

227 \$4.20

HANDBOOK OF RADIO, TV, INDUSTRIAL & TRANSMITTING TUBE & VALVE EQUIVALENTS

Equivalents book for amateurs and servicemen. More than 18 000 old and new valves from UK, USA, Europe, Japan et al. CV (military) listings with commercial equivalents included.

BP2 \$2.25

FIRST BOOK OF PRACTICAL ELECTRONIC PROJECTS

Full constructional data, circuits, components lists for many practical projects including audio distortion meter, super FET receiver, guitar amp, metronome, etc.

BP23 \$2.55

GIANT CHART — RADIO, ELECTRONICS, SEMI-CONDUCTOR & LOGIC SYMBOLS

Identify those symbols at a glance. A must for beginners and advanced enthusiasts alike. Professionals can always hide it in their desks! A steal at only . . .

BP27 \$2.20

IC555 PROJECTS

One wonders how life went on before the 555! Included are basic and general circuits, motor car and model railway circuits, alarms and noise makers plus section on subsequent 556, 558 and 559s.

BP44 \$6.45

MOBILE DISCO HANDBOOK

Most people who start mobile discos know little about equipment or what to buy. This book assumes no preliminary knowledge and gives enough info to enable you to have a reasonable understanding of disco gear.

BP47 \$4.55

ELECTRONIC PROJECTS FOR BEGINNERS

This book gives the newcomer to electronics a wide range of easily built projects. Actual components and wiring layouts aid the beginner. Some of the projects may be built without using soldering techniques.

BP48 \$4.55

LM 3900 IC PROJECTS

Unlike conventional op-amps, the LM 3900 can be used for all the usual applications as well as many new ones. It's one of the most versatile, freely obtainable and inexpensive devices around. This book provides the groundwork for simple and advanced uses — it's much more than a collection of projects. Very thoroughly recommended.

BP50 \$4.55

LONG DISTANCE TV RECEPTION (TV-DX)

Written by UK authority, the book includes many units and devices made by active enthusiasts. A practical and authoritative intro to this unusual aspect of electronics.

BP52 \$6.60

HOW TO BUILD YOUR OWN SOLID-STATE OSCILLOSCOPE

Project divided into sections for builder individually to construct and test — then assemble into complete instrument. Includes short section on scope usage.

BP57 \$5.05

SECOND BOOK OF CMOS IC PROJECTS

Leading on from book number 224 '50 CMOS IC PROJECTS', this second book provides a further selection of useful circuits mainly of a fairly simple nature. Contents have been selected to ensure minimum overlap between the two books.

BP59 \$5.05

BEGINNER'S GUIDE TO DIGITAL ELECTRONICS

Covers all essential areas including number systems, codes, constructional and sequential logic, analog/digital/analog conversion.

BP61 \$3.20

ELEMENTS OF ELECTRONICS

This series provides an inexpensive intro to modern electronics. Although written for readers with no more than basic arithmetic skills, maths is not avoided — all the maths is taught as the reader progresses.

The course concentrates on the understanding of concepts central to electronics, rather than continually digressing over the whole field. Once the fundamentals are learned the workings of most other things are soon revealed. The author anticipates where difficulties lie and guides the reader through them.

BOOK 1 (BP62): All fundamental theory necessary to full understanding of simple electronic circuits and components.

BOOK 2 (BP63): Alternating current theory.

BOOK 3 (BP64): Semiconductor technology leading to transistors and ICs.

BOOK 4 (BP77): Microprocessing systems and circuits.

BOOK 5 (BP89): Communications.

This series constitutes a complete inexpensive electronics course of inestimable value in hobby or career.

Books 1/2/3 \$7.60 (each)

Books 4/5 \$9.95 (each)

SINGLE IC PROJECTS

Simple to build projects based on a single IC. A few projects use one or two transistors as well. A strip board layout is given for each project plus special constructional and setting up info. Contents include low level audio circuits, audio power amps, timers, op-amps and miscellaneous circuits.

BP65 \$5.05

BEGINNER'S GUIDE TO MICROPROCESSORS & COMPUTING

Introduction to basic theory and concepts of binary arithmetic, microprocessor operation and machine language programming. Only prior knowledge assumed is very basic arithmetic and an understanding of indices.

BP66 \$5.90

COUNTER DRIVER AND NUMERAL DISPLAY PROJECTS

Well-known author F.G. Rayer features applications and projects using various types of numerical displays, popular counter and driver ICs, etc.

BP67 \$5.90

CHOOSING AND USING YOUR HI-FI

Provides fundamental info invaluable when buying hi-fi. Explains tech. specs, advice on minimum acceptable standards and specs for adequate sound. Also invaluable advice on how to buy and install and maximise your equipment's potential. Includes glossary of terms.

BP68 \$5.55

ELECTRONIC GAMES

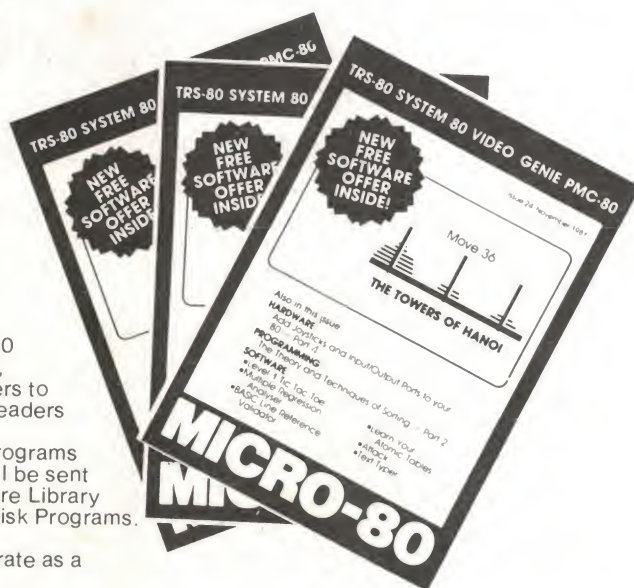
How to build many interesting electronic games using modern ICs. Covers both simple and complex circuits for beginner and advanced builder alike. Good one!

BP69 \$5.90

A wealth of information Free!

Special offer to all TRS-80 & System 80 owners

Software library valued at over \$100 FREE with every subscription to MICRO-80



MICRO-80 is a monthly magazine specifically for the owners of TRS-80 1 & 3 and System 80 micro computers. Owned and produced in Australia, each issue contains at least six programs, articles, useful hints and answers to readers' problems. Most of the programs and articles are written by our readers to whom we pay publication fees to help make their hobby pay.

MICRO-80 has developed a new Library of Software consisting of 7 programs and a comprehensive user manual. The Software Library, on cassette, will be sent FREE to every new subscriber. Disk subscribers will receive their Software Library on a diskette. The new Software Library contains the following Level II/Disk Programs. All programs will also operate on the Model III.

Level I in Level II—Convert your Level II TRS-80 or System 80 to operate as a Level I machine, opening a whole new Library of Software for your use.

Copier—Copies Level II System tapes, irrespective of where they load in memory. Copes with multiple ORG programs.

Z MON—A low memory, machine language monitor which enables you to insert break points, edit memory, punch system tapes etc.

Cube—An ingenious representation of the popular Rubiks cube game for Disk users.

Poker—Play poker against your computer. Complete with realistic graphics.

Household Accounts—This program is powerful enough to be used by a small business.

80 Composer—A music generating program which enables you to play music via your cassette recorder and to save the music data to tape or disk.

If you use a System 80 or TRS-80 you simply can't afford **not** to subscribe to **MICRO-80** and with our special Software offer, you'll have a wealth of information at your fingertips, absolutely free.

ATTENTION Hitachi Peach and TRS-80 colour computer owners.

Starting with the April, 1982 Edition, **MICRO-80** magazine will be catering for you with informative articles and new Software packages.

MICRO-80

**To MICRO-80
P.O. BOX 213, GOODWOOD,
S.A. 5034.**

**PLEASE SEND ME THE ITEM CHECKED BELOW
12 MONTHS' SUBSCRIPTION PLUS MY FREE
SOFTWARE LIBRARY**

- ☐ **MAGAZINE PLUS DISK \$125.00**
☐ **MAGAZINE PLUS CASSETTE \$65.00**
☐ **MAGAZINE ONLY \$26.00**

NAME

ADDRESS

.....POSTCODE

NO.

PLEASE DEBIT MY BANKCARD \$

EXPIRY DATE SIGNATURE

433 MORPHETT ST., ADELAIDE, S.A. 5000. TELEPHONE (08) 211 7244.

COMPUTING TODAY

New interface from H-P increases HP-41 power, versatility

A new interface system introduced to Australia by Hewlett-Packard enables a conventional handheld calculator to 'talk' with and control measurement instruments and other devices. The interface also provides the calculator with a mass memory capability, and the ability to communicate directly with a computer.

John Deftereos, Hewlett-Packard Area Manager for Personal Computing Products, says the new interface has numerous applications in business, science and engineering.

"We call it the HP-IL," Mr Deftereos explains, which stands for Hewlett-Packard Interface Loop.

"In effect, the HP-IL turns an HP-41 (Hewlett-Packard's top of the range handheld calculator) into a portable computer system. The calculator becomes a general purpose controller capable of transmitting and receiving data, and performing a wide variety of control functions."

The HP-IL module, which simply plugs into the calculator, enables the calculator to interface with a series of peripherals and measurement devices to form portable computational and information systems. These are suitable for use in the field, or in bench and desktop configurations.

Communication between HP-41 calculators and Hewlett-Packard

Series 80 personal computers is now possible with the HP-IL. This capability opens up many possibilities, such as collecting customer data in the field with an HP-41, then dumping, analysing and storing the data in the personal computer, and reloading it in the calculator.

Simultaneous with HP-IL release, Hewlett-Packard is introducing a number of instruments and peripherals for use with HP-41 calculators.

These include a digital cassette drive providing 131K of on-line mass storage — 50 times the memory of an HP-41 calculator, and a thermal printer/plotter which can produce hard copy data, bar codes and graphics. Both these peripherals are battery-powered and controlled by the calculator via the HP-IL.

A new five-function multimeter controlled by an HP-41 calculator can perform a range of measurement tasks. An HP-IL converter is a component designed to be built into other devices, such as measure-



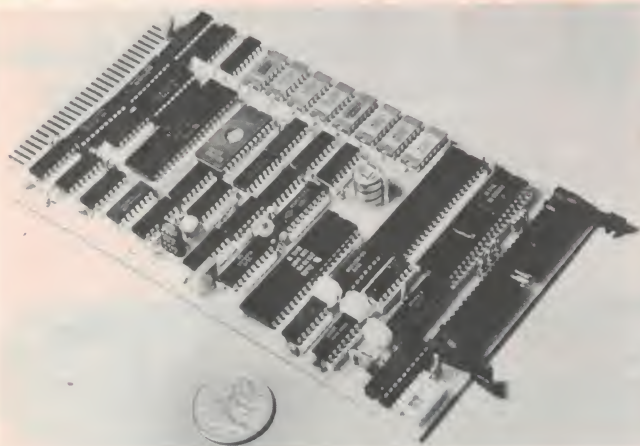
ment instruments. It connects the internal electronics of the machine to the HP-IL loop, allowing the machine to communicate with other devices on the loop and with the HP-41 controller.

"Hewlett-Packard is putting all its experience with interfaces into making HP-IL a high-quality, versatile interface," Mr Deftereos says.

"Our commitment to HP-IL means that many Hewlett-Packard divisions in the calculator, instrument and computer areas will be introducing HP-IL devices. For ex-

ample, many of our future handheld calculators and personal computers will support HP-IL. HP-IL also gives users great flexibility to expand and change the system according to their needs."

For further information contact Hewlett-Packard Australia Ltd, 31-41 Joseph Street, Blackburn, Victoria. (03)89-6351. Branches in Adelaide, Perth, Brisbane, Canberra, and Sydney (02)887-1611; also in Auckland and Wellington, New Zealand.



The 'little big board'

Pulsar Electronics has released a 'little big board' computer designed for industrial control users, business applications and the enthusiast; it measures just 115 x 200 mm.

It features a Z80A CPU running at 4 MHz, 64K of RAM on board, two serial (RS232C) input/output ports, 5" or 8" disk interface for double and/or single density, double-sided disks, a battery backed-up real time clock and calendar and an STD buss configuration.

The new board is available configured as follows:

- Assembled and tested with monitor program, with or without a

power supply.

- In a Hazeltine terminal, i.e. as a 64K intelligent terminal.
- With two double-sided, double density 8" floppy disk drives (2.5M of mass storage).
- As a complete terminal, with two disk drives and CP/M 2.2 installed.

Further information is available from Pulsar Electronics, 323 Bell St, Pascoe Vale Vic. 3044. (03)354-2125.

**FROM THE CENTRE OF U.K.'S ELECTRONICS INDUSTRY
WE BRING YOU THE BEST PRODUCTS IN COMPUTERS YOU CAN BUY.**

Memory expansion packs.

- 16K — Byte for Sinclair ZX81.
Price \$75.00
- 3K — Byte for Commodore
VIC 20 \$55.00
- 8K — Byte for Commodore
VIC 20 \$125.00
- 16K — Byte for Commodore
VIC 20 \$175.00



Compare our prices!! All items are ex stock U.K.

Please add \$ 10.00 P&P. Please allow 14 days for delivery.
Dealer inquiries welcome. Substantial discounts for quantity orders.

NAMAL ELECTRONICS

No 1 Claygate Road, Cambridge CB1 4QZ, U.K.
Telephone 0223 24 8257 (4 lines) Telex 817445 NAMLDN



Ph 398 6759
398 6571

**COMPUTER
CITY**

QUEENSLANDS FASTEST GROWING

MICRO APPLE DEALER

See us for our ever growing range

**APPLE NEC PEACH OHIO
CEC-500 CASIO ATARI**

**PRINTERS:— EPSON PAPER TIGER MICROLINE SILENT TYPE
STAR QUME TI 810 AND MANY OTHERS**

PERIPHERALS:— C.C.S. MOUNTAIN HARDWARE MICROSOFT. ETC.

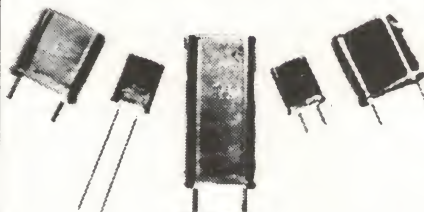
GREAT RANGE OF SOFTWARE — TOO MANY TO LIST. CALL US

COMPUTER CITY 600 OLD CLEVELAND ROAD, CAMP HILL, 4152, BRISBANE.

HAPPY

36th

ANNIVERSARY



Quantity Orders of Quartz Crystals
100 off or more available at very
competitive prices.

Ring 546 5076 for quotes.

Bright Star Crystals Pty.
Ltd.

PO Box 42, Springvale, Ph (03) 546-5076 Telex AA36004

FREE TRIP TO MELBOURNE

Computer Country is now proud to announce its "FREE TRIP TO MELBOURNE" plan. This plan applies only to interstate purchasers (non-Victorian) of a NEC PC-8000 Computer System or an Hitachi Peach Computer Package.

(Note — Plan applies only to those systems having a minimum configuration value of \$4,000 retail without sales tax.)

This is the perfect opportunity to purchase either one of some of the best computers systems on the microcomputer market. You can just buy hardware or add on any one of a number of software packages available which include word processing, general accounting, statistics, entertainment and educational.

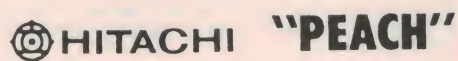
THE NEC PC-8000 PROFESSIONAL COMPUTER

It combines the most wanted features of existing micros with new features you have always been looking for.

These features include 4MHz Z-80 CPU, 80 x 25 display with graphics and 8 colours, 32K ROM, parallel/serial/cassette interface, upper/lower case, numeric keypad, 10 special function keys and real time clock — all built-in.

The NEC Professional Computer gives you much more for your money than almost any other micro on the market.

The NEC PC-8000 is supported nationwide by the Hanimex group of companies,



One of the most powerful new microcomputers on the market which uses the 6809 microprocessor. Comes with excellent super high resolution graphics — 640 x 200 dots and has a 40/80 character x 25 lines user programmable screen configuration.

Either choice will give you a great price, a great computer system, a free trip to Melbourne and a special training session as well.

All in all — a great deal from Computer Country.

COMPUTER COUNTRY PTY LTD

338 Queens St, Melbourne, Victoria 3000, (03) 329 7533.

Note — Those residing within the Sydney-Adelaide radius will receive 2 economy return air tickets from those capital cities. Outside that radius, eg Perth, Darwin and Brisbane, this offer is good for one economy return air ticket from those cities.



**S-100
SPECIALISTS**

283 CLARENCE ST
SYDNEY NSW 2000
TEL: 29-2402.

ARE YOU STILL WAITING??

FOR YOUR
MICROCOMPUTER ORDER?

While others are promising we
are delivering EX STOCK.
And we still have the best prices.
Just take a look at these:

RAM + 16

Features: S-100, 16K x 8 bit static RAM • 2 or 4 MHz • Uses 2114 1K x 4 static RAM chip • 4K step addressable • 1K increment memory protection, from bottom board address up or top down • Deactivates up to 6 1K board segments to create "holes" for other devices • DIP switch selectable wait states • Phantom line DIP switch • Eight bank select lines expandable to 1/2 million byte system • Data, address and control lines all input buffered • Ignores I/O commands at board address.

Bare Board	\$ 35.00
4Mhz kit	\$174.00
4Mhz A&T	\$199.00
Kit no RAM	\$120.00

DYNAMIC RAM

T.I. 4116-3 16K for \$16.00
Upgrade Super 80, TRS 80, and others
Expandable + 64K. \$100)
Dynamic RAM Board A&T \$325.00
Guaranteed to work at 4Mhz or your money back

QT SILENCE-MOTHERBOARDS

The Silence + has become one of the most tried and proven motherboards on the market. Using a unique grounding matrix, each line is completely surrounded with ground shielding which eliminates necessity for termination and gives the unit a very high cross talk rejection. One of the OEM customers has used the Silence + as high as 14Mhz without terminations.

FEATURES:

- LED power indicator
 - Eliminates necessity for termination
 - Fits most industry standard mainframes
 - Available in 6, 8, 12 and 18 slot configurations
- | | | |
|---------------|--------------------|----------|
| QTCMB6BB | 6 Slot Bare Board | \$ 31.00 |
| QTCMB6A | 6 Slot A&T | \$ 81.00 |
| QTCMB8BB | 8 Slot Bare Board | \$ 33.00 |
| QTCMB8A | 8 Slot A&T | \$104.00 |
| QTCMB12BB | 12 Slot Bare Board | \$ 39.00 |
| QTCMB12A | 12 Slot A&T | \$138.00 |
| QTCMB18BB | 18 Slot Bare Board | \$ 61.00 |
| QTCMB18A | 18 Slot A&T | \$178.00 |
| \$100 Sockets | Solder Tail (Gold) | \$ 630 |

SYSTEM + II (2MB +)

Computer system with 8" Dual Sided Drives
(uses Y-E DATA YD174 Disk Drives) Terminal not included.

A&T (6 Slot)	\$3883.00
A&T (8 slot)	\$4083.00

QT Systems are designed for both businessmen and engineers in accordance with the latest IEEE standards. Among other functions, they can be used for accounting and word processing as well as a variety of scientific applications. The systems are available with MP/M or QT DOS operating systems to allow multi-user, multi-tasking operations. QT also offers a full line of business and applications software, ranging from a business package to word processing.

Technical specifications. 4 MHz Z-80 CPU • Dbl-sided, dbl-den 5 1/4" or 8" floppy disk controller (handles both drives simultaneously) • CP/M 2.2 included • 64K RAM, expandable per your requirements • Comes complete in single mainframe • RS232C serial port • Parallel port • Hard disk compatible • Monitor program & disk routines included on EPROM • Power-on/reset jump to monitor program • Documentation included • Extensive software available.

SOFTWARE +

Word processing • System utilities and diagnostics • Games • CP/M users group diskettes \$10.00 each, catalogue \$6.00 • Pascal, Fort, Tarbell Basic, Fortran and most other compilers and utilities are available • Complete range of business software • Custom programming can be arranged on a fixed price or hourly basis.

SBC2/4 Z80 S100 SINGLE BOARD COMPUTER

The QT Computer SBC2/4 Processor Board is a versatile and powerful Z80 based design which is compatible with the proposed IEEE S-100 bus standard. Although the SBC2/4 may be used as the host CPU of a large system, it has all the necessary features to be used as a stand-alone computer system.

Unlike old designs it will work reliably with dynamic RAM boards and more importantly with soft sector disk controllers, and hence standard versions of CP/M. This will give you access to the largest software base for microcomputers.

- Z80A 8 bit CPU
- 2 or 4 Mhz Switch selectable
- 1K RAM (which can be located at any 1K boundary)
- Full 64K use of RAM allowed in shadow mode
- DMA compatibility allows MWRT signal generation on CPU board or elsewhere in system under DMA logic or front panel control
- TWO programmable timers available for use by programs run with the SBC2/4 (timer output and controls available for use on CPU board).

Shipping weight: 2lbs.

QTCSCB24B	Bare Board	\$ 66.00
QTCSCB24C	Kit	\$199.00
QTCSCB24A	Assembled and Tested	\$269.00

MF + MD MAINFRAME



The MD+MD Mainframe offers the same quality as the MF+. It accepts two 5 1/4" disk drives with remaining space for either a 6, 8, or 12 slot Silence Plus Motherboard.

QTCMFMD	without Motherboard	\$400.00
QTCMFMD6	with 6 Slot Motherboard	\$480.00
QTCMFMD8	with 8 Slot Motherboard	\$500.00
QTCMFMD12	with 12 Slot Motherboard	\$540.00
QTCMFMDB	bare metal work	\$175.00

Also available without cutouts on front panel

DISK CONTROLLER

CCS2422A features ROM bootstrap loader and monitor • CP/M 2.2 with documentation included • Accepts 5 1/4" and 8" disk drives • Double sided/single sided select • Read, write IBM 3740 or system 34 single or double density • Fast seek available for voice coil operation • Automatic disk density determination • ROM bootstrap phantom.

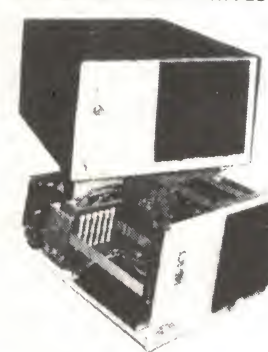
CCS2422A A & T Incl. CP/M 2.2	\$399.95
JADE DD Bare Board	\$ 85.00
QTFDC II A&T Incl. QT DOS	\$379.00
Disk Drive cables made to order	P.O.A.

MINI-SYSTEM + (1/2MB +)

Computer System with 5 1/4" Single Sided Drives (uses TEAC FD-50A Disk Drives) Terminal not included.

A&T (6 slot)	\$3048.00
A&T (8 slot)	\$3073.00

MAINFRAMES S-100 MAINFRAME FOR DUAL 8" DISK DRIVES



AT LAST! A desk top enclosure that will accommodate a S-100 bus system and two 8" disk drives. The MF+MD mainframe is the most versatile dual 8" mainframe on the market. It will accommodate 6, 8, or 12 slot card cages using the Silence + motherboards. Just add a CPU, memory board, disk controller and terminal and you have an inexpensive, high quality computer system.

FEATURES:

- Accommodates and 8" standard disk drive (801R, DT-8, etc.)
- IEEE S-100 Silence + 6, 8 or 12 slot motherboard available. (See motherboard description at left.)
- Keyed power switch.
- Reset switch on front panel.
- Anodized 6, 8 or 12 slot cages.
- Quiet fan provides cool system operation featuring filtered positive air pressure. User may add two additional fans for the 12 slot if required.
- Detachable line chord plugs directly into EMI filter for electrical noise suppression.
- 16 DB25 cut out
- 2 50 pin plug connector cut outs.
- 2 DD55 cut outs.
- Dimensions 9 5/8" x 17" x 21" (HxWxD)
- Power supply +8V@25A/+ 16V @ 5A/ +5@2.5A/-5@5A/+24V@3A
- Input Voltage 110-113VAC/220-240VAC 50-60 Hz

QTCMFDD	without Motherboard	\$575.00
QTCMFDD6	with 6 Slot Motherboard	\$625.00
QTCMFDD8	with 8 Slot Motherboard	\$650.00
QTCMFDD12	with 12 slot Motherboard	\$700.00
QTCB	Bare Metalwork	\$175.00

PERIPHERALS +

We have fantastic specials on printers, terminals, plotters and disk drives. Call or write for details and pricing. Here are some examples:

YD-174 8" DS/DD Drives.....	@ \$625.00
2 for.....	\$1200.00
VIEWPOINT Terminal 80x24 detachable keyboard.....	\$995.00
Hazeltine Esprit 80 x 24	
Green Screen. Emulates other terminals.	
Optional Graphics. Best value.....	\$975.00
WATANABE 6 colour plotter.....	\$1295.00
TEAC and MPI mini drives, 40 or 80 track.	
Single or double sided. Our prices are too low to advertise!! We carry a complete range of cabinets and power supplies for 5 1/4" and 8" drives for single and dual drives.	
ITOH DAISYWHEEL 25 cps (parallel).....	\$1500.00
Serial or 40 cps optional.	
ITOH M8510 Graphics Printer	
Parallel version (serial optional)	\$ 795.00

LIMITED STOCKS
64K static RAM
Intermix RAM
and EPROM
200 nano. Very low power.
Kit No RAM \$149

256K S-100 Dynamic Ram LIMITED STOCKS!!

• Full IEEE 696	
• Assembled and tested, with 64K or 256K	
CR256-64	\$795.00
CR256-256	\$995.00

PLACE YOUR BANKCARD ORDERS BY PHONE!! WE DELIVER OVERNIGHT ANYWHERE IN AUST. FOR \$3.50 up to 4kg. Or \$10 up to 10kg.

WE HAVE A COMPLETE RANGE OF S100 BOARDS AND MICROCOMPUTER PRODUCTS IF THE PRODUCT YOU REQUIRE IS NOT ADVERTISED DUE TO LACK OF SPACE PLEASE CALL OR WRITE.

OUR 1982 CATALOGUE IS NOW
AVAILABLE. SEND S.A.E.
FOR FREE COPY!!

PRICES DO NOT INCLUDE SALES TAX OR DELIVERY. AND ARE SUBJECT TO
CHANGE WITHOUT NOTICE.



GBUG — powerful monitor for 2650 microcomputer systems

A powerful new monitor for 2650-based microcomputer systems has been developed by local programmer Laurie Gellatly.

It supersedes the widely used PIPBUG and BINBUG 2650 monitors and features:

- Screen editing while using character input routine with corrected line passed back
- Edit mode constantly identified by blinking cursor
- Extra and extended commands
- Fast, controlled, flicker-free scrolling

GBUG is a 1.5K monitor which can either be stored totally in ROM or 1K of ROM + 0.5K RAM. The 1K of ROM is located at 0000 HEX; the remainder is located at 5800 HEX (although any location could be used). An ETI-640 memory-mapped VDU is the initial output device. The monitor will write down the screen and scroll when it reaches the bottom line. Serial input is at 300 Baud (600 Baud for 2 MHz clock) and 2650A-1 microprocessor via the sense pin, while serial output is via the flag pin at the same rate.

GBUG is claimed to correctly handle CR, LF, BS (BACK SPACE), FF (FORM FEED) and HT (HORIZONTAL TAB) keyboard commands. Ctrl U and Ctrl D are used for entry to the edit mode. Other control characters are ignored by CHIN/COU subroutines (Character Input/Character Output).

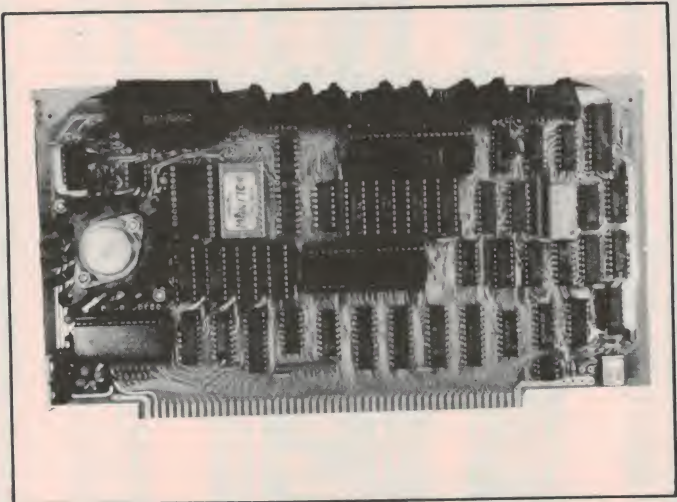
The following commands are employed:

A: Alter/Inspect memory. Syntax **Ammmm**. Starting at location mmmm outputs the location then the hex value thereof. If a new value is typed in then the last two hex characters replace the old value. Leading zeros need not be entered. If no new value is entered the contents are unaltered. An LF will move on to the next address. A CR terminates this command.

B: Breakpoint setup. Syntax **Bmmmm**. Replaces location mmmm and mmmm+1 by an instruction to branch to a save register routine and stop. When the processor encounters a breakpoint it saves its registers and prints out the breakpoint location. Because all registers are saved, when the breakpoint is encountered the user can then inspect the registers and resume execution. This feature allows a program to be examined in sections.

C: Clear breakpoint. Syntax **C**. Clears breakpoint by replacing data to its original location and displaying the address that was cleared. If no breakpoint has been set a '?' error results.

D: Dump/DOS. Syntax **Dssss eeee gggg**. Dump to serial media or go to Disk Operating System. 'Dump' serially outputs the information from memory location ssss to eeee in a format suitable for storage on tape and later loading via the load routine. If gggg is supplied, then after loading a branch to



that address is performed.

ssss = start address

eeee = end address

gggg = optional go address

If D alone is entered then a branch to DOS is performed.

F: Freeze top lines of screen. Syntax **Fx**. Will freeze from scrolling or clearing the top x hex lines; x can be any hex number from 0 to F. If x is omitted, 0 is assumed.

G: Go to address. Syntax **Gmmmm**. All registers are loaded from any previously stored values (either via a Breakpoint or set via the 'S' command) and a branch to address mmmm is performed.

L: Loads from serial media. Syntax **L**. Loads memory from a serial device.

P: Printer echo On/Off. Syntax **Px**. Will send serial characters to a printer and to the screen. x can be any hex number 0 to FF. If x=0 then this feature is invoked. If x = 0 or is omitted then characters are only printed on the screen. This uses the extended output feature.

Q: Quick Scroll. Syntax **Qx**. As the second K of the ETI-640 is usually unchanged the processor would do unnecessary work shifting this when scrolling is required. When used, this command only scrolls the first K

of screen. This halves the time to scroll the screen.

S: See and set registers. Syntax **Sx**. Any value from 0-8 can be used for x, which selects the first register to be examined. The register contents are displayed and are altered as with the 'A' command. Responding with an LF moves on to the next register except after the eighth, where a '?' error results. Response of a CR terminates the command. Note that these values are given to the appropriate registers upon a 'G' command. This command is also used to inspect the registers after a breakpoint has been encountered.

V: VDU Scroll control. Syntax **Vx**. Will stop the screen every 15 lines and wait for a key to be pressed before continuing.

A number of extra control characters are decoded. These are:

TAB: When an HT (Ctrl I; 09 hex) is output via the COU subroutine the cursor will move to the next horizontal tab position to the right of the current cursor position.

FORM FEED: When an FF (Ctrl L; 0C hex) is output via COU all non-frozen lines on the screen will

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070. MELBOURNE. (03) 489-8131.

ELECTRONIC COMPONENT SUPPLIERS, DESIGNERS & MANUFACTURERS.
RITRONICS WHOLESALE (03) 489-7099. MAIL ORDERS (03) 481-1436.

TELEX: AA38897

For heavier items add additional postage. Extra heavy items sent Comet freight on. Prices subject to change without notice. Send 60c and SAE for free catalogues. Minimum pack and post \$1.00. Bankcard Mail Orders welcome.

SUPER SPECIALS

2708	\$ 4.50	BU326	\$ 1.90
2716	\$ 4.90	Z80S10	\$21.00
2732	\$ 8.00	1771	\$19.00
6800	\$ 7.90	1791	\$59.00
6802	\$11.00	4116	\$1.95
6809	\$22.00	2114	\$ 2.50
8085	\$12.50	TA7205	\$ 3.30
8080	\$ 7.00	100 Red Leds	\$ 9.00
6821	\$ 3.50	BUX80	\$ 3.90
Z80P10	\$ 5.00	BU126	\$ 1.90

CMOS	74C04	.40	LF356-AN	1.10	UA4558TC	1.40	7494	.90
4000	74C08	.40	LF357	1.10	MM5837	2.50	7495	.45
4001A	74C10	.40	LM358	.70	LM7555	1.80	7496	.80
4001B	74C14	.90	LM373	4.10	Mc10116L	.95	7497	2.50
4002	74C20	.40	LM374	5.40	LF13741	.60	74107	.80
4006	74C30	.40	LM376	.70	LF13741-H	.70	74109	.60
4007	74C32	.40	LM377	2.90	DS75452	.60	74116	2.20
4008	74C42	1.10	LM379	5.70	76477	4.90	74121	.45
4009	74C48	1.55	LM308 8PIN	1.30	75451	.60	74122	.65
4010	74C73	.75	LM380	1.40	75491	1.40	74123	.60
4011	74C74	.70	14PIN	1.50	75492	1.40	74125	.55
4012	74C76	.75	LM318A-N	2.40	TTL (s)	74126	.60	
4013	74C83	1.40	LM318N	1.80	74500	.80	74132	.80
4014	74C85	1.20	LM382N	2.00	74502	.80	74141	1.10
4015	74C86	.80	LM383	2.70	74504	.80	74145	.85
4016	74C90	.80	LM384	2.40	74510	.75	74147	2.00
4017	74C93	1.40	LM386	1.00	74511	.75	74148	1.40
4018	74C95	.95	LM387	1.30	74532	.75	74150	1.20
4019	74C107	.70	LM391	1.80	75551	.75	74151	.60
4020	74C150	3.40	LM393	.80	74574	1.20	74152	4.90
4021	74C151	1.00	LF398	5.00	74586	1.40	74153	.70
4022	74C160	.90	8038	6.00	745112	1.20	74154	1.20
4023	74C192	.90	NE530	1.10	745135	2.20	74155	.90
4024	74C164	1.10	OM350	9.90	745138	3.20	8128	3.00
4025	74C173	1.00	555	.40	745157	2.95	9310	.65
4026	74C174	.80	556	1.10	745158	2.95	9311	1.00
4027	74C175	1.00	LM565	1.30	745182	3.30	9312	1.35
4028	74C192	1.20	LM565CH	2.00	7400 SERIES	74156	1.50	
4029	74C195	1.00	NE566	2.50	7400	.40	74157	.60
4030	74C221	1.90	LM567	1.50	7401	.40	74161	1.00
4031	74C373	1.80	NE571	6.50	7402	.40	74162	1.00
4034	74C374	2.00	LM709 14PIN	.70	7403	.40	74163	.85
4035	74C901	.90	UA710CA	.60	7404	.40	74164	.60
4039	74C902	.90	LM710-CH	.90	7405	.50	74165	.60
4040	74C905	11.20	711	.80	7406	.50	74174	.50
4041	74C906	.90	UA711-H	.85	7407	.50	74175	.90
4042	74C907	.80	UA716HC	6.25	7408	.40	74176	1.10
4043	74C915	1.50	723	.50	7409	.40	74177	1.10
4044	74C922	3.80	LM723CH	1.10	7410	.40	74180	.90
4046	74C923	5.00	LM725	3.90	7411	.40	74181	2.30
4047	74C925	7.50	LM733	1.20	7412	.40	74182	.90
4048	74C926	7.50	UA739	2.00	7413	.50	74184	3.75
4049	74C927	5.90	741	.25	7414	.70	74185	1.20
4050	74C932	5.50	LM741-H	1.20	7416	.50	74190	1.00
4051	80C SERIES		UA747	1.00	7417	.60	74191	1.50
4052	MM80C95	.90	UA747HC	2.20	7420	.40	74192	1.70
4053	80C96	.90	UA748	.50	7421	.40	74193	.80
4060	MM80297	.90	UA748HC	1.25	7423	.50	74194	1.10
4066	80C98	.90	UA753	1.80	7425	.45	74195	.65
4068	LINEAR		UA760HC	4.10	7426	.40	74196	.85
4069	LM0002	9.50	UA777HC	2.40	7427	.40	74197	1.10
4070	LM0022CD	16.60	9334	2.65	7430	.40	74198	1.10
4071	LM0042CH	8.60	7432	1.70	7432	.40	74199	1.30
4072	LM0070	12.70	7433	1.80	7437	.40	74221	.90
4073	LM0071	12.70	UA760HC	4.10	7438	.50	74290	.90
4075	LM071	1.00	UA796HC	1.70	7440	.50	73293	.90
4076	LM072	1.50	LM802	1.70	7441	1.00	74365	.80
4077	LM082	1.50	LM1310N	2.40	7442	.50	74366	.80
4078	SAK140	2.20	1408	4.90	7443	1.40	74367	1.00
4081	UA170	3.50	LM1458	.60	7444	1.20	74368	1.00
4082	UA180	3.50	UA1488	1.50	7445	1.10	8196	1.80
4089	TCA220	2.20	UA1489	1.50	7446	1.00	9314	1.30
4093	LM301	.50	MC1495	7.30	7447	1.00	9368	1.75
4503	LM301-H	.50	MC1496L	11.40	7448	1.00	9370	2.00
4510	LM304-H	1.70	LM1558	1.50	7450	.50	74LS SERIES	
4511	LM305-H	.80	LM1596	1.40	7451	.40	74LS00	.40
4512	LM307-CN	.40	LM1380	3.10	7453	.40	74LS01	.40
4514	LM307-H	.90	LM2902	1.40	8126	2.20	74LS02	.40
4516	LM308	.70	LM2917	9300	.60	74LS03	.40	
4518	LM308-H	1.20	8PIN	2.80	9307	1.80	74LS05	.40
4519	LM310-N	2.20	LM2917	3.10	9308	1.20	74LS08	.40
4520	LM310-H	2.60	CA3028	1.80	7454	.60	74LS09	.40
4522	125 311	.60	LM3039	.90	7472	.60	74LS10	.40
4527	LM311	.60	CA3046	1.70	7473	.60	74LS11	.40
4528	LM311-H	1.20	3065	.45	7474	.60	74LS13	.50
4529	LM318	2.80	LM3080	1.20	7475	.60	74LS14	.90
4539	LM322	3.90	LM3089	.90	7476	.60	74LS15	.40
4541	LM324	1.20	CA3130T	1.40	7480	.65	74LS20	.40
4543	LM325	3.10	CA3130E	1.80	7482	1.80	74LS21	.40
4553	LM329-DZ	1.40	CA3140	1.40	7483	.80	74LS22	.40
4555	LM334-Z	1.30	3401	1.10	7485	.80	74LS26	.40
40097	LM335	12.40	3611	1.70	7486	.80	74LS28	.40
40098	LM336-Z	3.20	LM3900	.90	7489	2.60	74LS30	.40
40175	LM339	.90	LM3909	1.00	7490	.70	74LS32	.40
74C SERIES	LM348	1.10	LM3914N	.90	7491	.55	74LS33	.40
74C100	LM349	1.80	4136	1.40	7492	.60	74LS37	.50
74C02	LF351-N	.70	LM4250	1.75	7493	.60	74LS38	.50

DIP SWITCHES SPST

P/N	No. Switches	Price
SD3	3	1.60
SD4	4	1.70
SD5	5	1.90
SD6	6	2.30
SD7	7	2.40
SD8	8	2.50
SD9	9	2.70
SD10	10	3.00

18 Pin	1.50	1.40	22,000uf	25V	12.90
20 Pin	1.80	1.60	22,000uf	40V	23.00
22 Pin	1.90	1.70	27,000uf	35V	23.50
24 Pin	2.00	1.80	33,000uf	16V	21.50
28 Pin	2.20	2.10	68,000uf	16V	23.50
36 Pin	2.60	2.40	100,000uf	10V	20.50
40 Pin	2.90	2.70			

COMPUTER GRADE ELECTRO.

2900uf	40V	6.50
6800uf	16V	6.40
10,000uf	16V	9.00
10,000uf	25V	9.50
10,000uf	40V	11.90
15,000uf	40V	12.00

MULTISTRAND RIBBON CABLE

Price per metre	1-9	10+
10 Way	.90	.80
12 Way	1.00	.90
16 Way	1.20	1.10
20 Way	1.70	1.69
40 Way	3.20	3.00

WIRE WRAP 3-LEVEL

8 Pin	1.00	.90
14 Pin	1.10	1.00
16 Pin	1.20	1.70

74LS40	.50	81LS97	2.10	2N5874	1.40	TIP32C	1.00	8295	25.00
74LS42	.75	TRANSISTORS		2N5961	.30	TIP33A	1.10	DM8578	3.50
74LS47	.85	2N301	2.20	2N5963	1.10	TIP34A	1.20	Av-5-2376	19.56
74LS48	1.00	2N657	.60	2N6027	.60	TIP24B	1.50	8748A	99.00
74LS49	1.00	2N930	.60	3N201	.90	TIP42B	1.10	8755A	99.00
74LS51	.40	2N1613	1.10	AC127	.70	TIP110	1.30	MCT2	.80
74LS54	.50	2N1711	.50	AC128	.70	TIP120	1.30	MCT6	3.30
74LS55	.55	2N1893	1.00	AC187	.70	TIP2955	1.20	MCT275	1.50
74LS58	.65	2N219A	.60	AC188	.70	TIP3055	1.20	MCC671	3.00
74LS73	.55	PN2222	.20	AD149	2.50	VN88AF	2.50	4N28	.85
74LS75	.60	PN2222	.30	AD161	1.70	MICRO CHIPS		4N33	1.20
74LS76	.50	2N2463	.35	AD162	1.70	ADCO 800	12.00	4N26	.85
74LS78	.50	2N2484	.65	BC318	.30	DACO 080	2.00	MM80C95	.90
74LS83	1.00	2N2646	.70	BC319	.18	2012 200 NS2.00		80C96	.90
74LS85	1.00	2N2647	1.10	BC327	.15	2102 350 NS2.00		MM80C97	.90
74LS86	.50	2N2894	.80	BC328	.30	2102 450 NS1.40		8098	.90
74LS90	.70	2N2904	.45	BC337	.30	2102 650 NS1.40			
74LS92	.90	2N2905	.40	BC338	.30	2111	8.60	OPTOCOUPERS	
74LS93	.80	2N2906	.45	BC547	.15	2114 150		MCT2	1.00
74LS95	.65	PN2907	.30	BC548	.15	NS	11.15	MCT6	3.30
74LS96	1.55	2N3053	.60	BC549	.15	2114 300 NS3.90		MCT275	1.50
74LS107	.60	2N3054	.90	BC557	.16	2114 450 NS3.50		MCC671	3.00
74LS109	.60	2N3055	.90	BC558	.16	8-31	3.30	4N28	1.00
74LS112	.60	2N3301	.40	BC559	.16	32 up	3.10	4N33	1.20
74LS113	.65	2N3440	1.10	BC637	.25	2513	14.50	4N26	1.00
74LS114	.50	2N3502	.70	BC638	.36	2516	55.00	VOLTAGE	
74LS122	.50	2N3503	.70	BC639	.90	2532	69.00	REGULATORS	
74LS123	.75	2N3563	.30	BC640	.90	2650	23.00	78L05	.40
74LS125	.50	2N3564	.30	BCY70	.85	2708	8.50	LM341P-5	.80
74LS126	.70	2N3569	.30	BCY71	.85	2716	12.00	7805	1.00
74LS132	.80	PN3565	.30	BD115	1.50	4101	5.00	7905	1.70
74LS133	.50	PN3566	.30	BD135	.70	5116	9.00	LM309K	1.20
74LS136	.50	PN3567	.30	BD136	.70	MM5204	12.50	7805K	2.10
74LS138	1.20	2N3568	.30	BD137	.70	MM5220	7.20	LM323-K	6.90
74LS139	.85	2N3638	.30	BD138	.70	MM5307	18.00	78H05K	8.50
74LS151	.75	2N3639	.30	BD139	.70	MM5309	6.50	LM341P-8	.80
74LS153	.60	2N3640	.30	BD140	.70	MM5312	9.00	78L12CP	.40
74LS154	1.50	2N3641	.30	BD235	.65	MM5369	2.60	79L12	.65
74LS155	1.00	2N3645	.30	BD234	.50	5387	8.50	LM341P12	.75
74LS156	1.00	2N3642	.30	BD237	.50	MM5395	6.50	7812	1.00
74LS157	.90	PN3643	.30	BD262	1.20	6502	10.50	7912C	1.90
74LS158	.70	PN3644	.30	BD301	.75	6508	5.50	7812KC	2.15
74LS160	.85	2N3646	.30	BD302	.75	6520	5.00	7912KC	2.60
74LS161	.85	2N3692	.50	BD263	1.25	6522	10.50	79H12KC	8.00
74LS162	1.00	2N3693	.35	BD435	.75	6551	17.00	78L15	.35
74LS163	.85	PN3702	.30	BD646	1.70	6563	17.00	79L15	.65
74LS164	1.30	PN3694	.30	BD647	1.80	MCM690P	9.00	LM341P15	.80
74LS165	.50	2N3704	.30	BD675	.50	MC6802	13.60	7815	1.00
74LS168	1.90	2N3709	.30	BDV648	4.50	MC6808	12.50	7915CT	2.80
74LS169	1.90	2N3713	2.20	BDV658	4.50	6810A	4.90	7915KC	2.60
74LS170	2.80	2N3819	.80	BF115	.50	6820	5.50	78H15KC	6.50
74LS173	.90	2N3866	2.00	BF173	.70	6821	6.00	7818	.35
74LS174	.90	2N3904	.30	BF180	.70	6850	5.15	78L24	.35
74LS175	.90	2N3906	.30	BF195	.30	6852	6.00	78L24	.65
74LS181	2.50	2N4030	1.10	BF198	.30	7106	12.60	79L24	1.10
74LS189	3.80	2N4032	.55	BF199	.30	7107	15.00	LM371T	2.40
74LS190	1.30	2N4033	.90	BF336	.80	7210	13.20	LM373T	3.80
74LS191	1.10	2N4036	1.00	BF337	.80	Z80 CPU	14.00	LM317K	4.50
74LS192	.85	2N4037	.90	BF458	.90	Z80A P10	16.00	LM337K	5.90
74LS193	.85	PN4121	.30	BF494	.40	Z80A P10	16.00	LM350K	8.40
74LS194	.70	2N4233	1.60	BFX85	.75	Z80 CTC	13.50	78HGKC	10.50
74LS195	.80	2N4235	1.90	BFY50	.90	Z80A CTC	16.50	78P05	16.50
74LS196	1.25	2N4236	2.20	BFY90	1.30	Z80 DMA	40.70	BRIDGES	
74LS197	1.00	2N4248	.30	BSV17	1.00	Z80 S10/0	56.90	VM48	1.50
74LS221	1.10	PN4249	.30	BU126	3.00	Z80 S10/1	56.90	W02	.60
74LS245	2.35	2N4250	.30	BU208	3.00	Z80 S10/1	56.90	W04	.60
74LS247	.90	2N4258	.30	BUX80	7.90	Z80 S10/2	56.90	KHPC02	2.00
74LS249	1.30	2N4292	.70	F12955	.40	S10/0	63.00	KBP602	2.50
74LS251	.80	2N4354	.30	T3055	.75	Z80A		KBP604	2.60
74LS253	.90	2N4355	.30	MEL12	.90	S10/1	63.00	KBP606	2.80
74LS257	.65	2N4356	.30	J3C26A	3.40	Z80A		KHPC1002	2.60
74LS258	.50	2N4398	5.00	MJ2955	1.00	S10/2	63.00	KBP6100A	3.20
74LS259	2.45	2N4401	.30	MJ4325	7.40	8035	27.00	KBP6100B	3.20
74LS260	.90	2N4402	.30	MJ802	.30	INS8050	15.00	MDA3501	3.40
74LS266	.90	2N4403	.50	MJ4035	6.90	INS8080	8.00	MDA3502	3.20
74LS273	1.60	2N4416	1.00	MJ4502	3.70	P8085	25.00	MDA3504	3.40
74LS279	.65	2N4906	2.80	MJ4502	3.70	P8085	25.00	DISPLAYS	
74LS283	1.15	PN4868	.30	MJ4502	3.70	P8085	25.00	MAN2A	6.30
74LS290	1.10	2N5088	.30	MJ4502	3.70	P8085	25.00	MAN72A	2.20
74LS293	1.15	2N5089	.30	MJ4502	3.70	P8085	25.00	MAN74A	2.20
74LS295	1.60	2N5179	1.90	MJ4502	3.70	P8085	25.00	MAN82A	3.40
74LS298	1.00	2N5303	3.30	MJ4502	3.70	P8085	25.00	MAN85A	3.40
74LS352	1.30	2N5320	.80	MJ4502	3.70	P8085	25.00	MAN84A	3.40
74LS353	1.30	2N5401	.30	OF102	.60	8224	5.50	MAN6740	3.60
74LS365	.50	2N5458	.70	MPS131	.60	8226	7.50	MAN8610	3.30
74LS366	.70	2N5459	.70	MPSA05	.60	8228	9.50	MAN8640	3.30
74LS367	.90	2N5461	.70	MPSA06	.60	8243	8.00	TL330b	12.00
74LS368	.90	2N5484	.70	MPSA12	.60	8243	8.00	DL704	2.20
74LS373	1.50	2N5485	.70	MPSA14	.60	8251	14.00	DL707	2.30
74LS374	1.70	2N5486	.70	MPSA42	.60	INS8251	15.00	DL747	3.40
74LS386	.50	2N5769	.30	MPSA56	.80	8253	19.00	DL750	4.00
74LS670	2.70	2N5770	.25	MPSA92	.60	8255A	8.50	FND357	1.80
74LS95	2.10	2N5830	.25	MF475	4.40	8259	99.00	FND500	1.80
HS90	11.50	2N5831	.30	TT318	.90	8275	99.00	FND507	1.80
C90	19.50	2N5856	.30	TT3PC	1.00	8275	99.00		
LS96	2.10	2N5873	1.10	TIP32B	.90	8278	99.00		

FROM THE S100 SPECIALISTS

What Makes AED's S100 SuperComputer Different?

— IEEE S100 construction — 4 or 6MHz Z80 or 5MHz 8085 and 8088 operation — Super Reliable Static RAM, drawing less power than Dynamic — Super Fast Memory Mapped "Un-Serial" Terminal — CP/M 2.2 plus SUPERAED — Realistic System Pricing.

SUPERAED features:

— Automatic Background Memory Testing — Keyboard Lockout with Password Re-Entry: A cold boot is not enough to bypass the password, either! — Automatic Memory Corruption monitoring during lockout — Help: Menu driven user assistance program — Smartkey: Keyboard Intelligence system — Monaed: Advanced Monitor program, accessible from within CP/M! — Keyboard and Software selection of up to 8 printers — Keyboard and Software controlled display speed — Chunky Graphics — Alternate character sets available — Keyboard Substitution: Now your BASIC or machine code (or whatever) program can perform CP/M keyboard entries, and hence console functions directly — has to be seen to be believed.

Drop in to our Showroom at GUILDFORD for a demonstration of the AED SUPERCOMPUTER, other AED Turnkey systems, the STARTER System, and the Exidy Sorcerer.



**MICROCOMPUTER
PRODUCTS**
OPEN 9-6 MON-SAT

130 MILITARY ROAD
GUILDFORD NSW 2161
PHONE (02) 681 4966
TELEX AA70664

SPELLGUARD* can proofread 10,000 words in one minute

SPELLGUARD is a revolutionary new computer program that finds spelling mistakes and typographical errors in documents prepared with CP/M¹ or CDOS⁵ compatible word processors and text editors.

In less than one minute, SPELLGUARD proofreads 20 pages of text (10,000 words) and identifies all misspelled or mis-typed words based on its 20,000-word dictionary. After proofreading, SPELLGUARD first provides an alphabetised list of the words identified as potential errors. The operator judges each word as correct or incorrect. Correct words may be added to the dictionary. SPELLGUARD *automatically* marks incorrect words in the text with a special character. The operator can then use the word processor to easily find and correct them in the document.

Distributed by:
S.I. MICROCOMPUTER
PRODUCTS PTY. LTD.
who can supply further details.
Price: \$325 including manual
(Trade discounts available)

*TM

Print-out

Sharp handheld with advanced design features

A new handheld personal computer system which incorporates features and memory capability previously unavailable in a machine of its size was recently announced at the Las Vegas Winter Consumer Electronics Show by Richard Brayden, General Manager of Sharp Electronics Corporation's Systems Division in the US.

The new computer, model PC-1500, features a 7 x 156 programmable dot matrix liquid crystal display, an extended BASIC language operating system capable of handling two-dimensional arrays, variable string lengths, program chaining, full graphic commands and many other functions.

The PC-1500 has 16K of system ROM and 2.6K (expandable to 6.6K) of user-available RAM. The unit can also generate a full upper and lower

case ASCII character set, as well as providing user-definable function keys for rapid programming and operation.

The PC-1500's optional printer provides four-colour graphic capability, nine different character sizes, bi-directional line feed and x, y plotting capability. The printer also incorporates a dual cassette interface for program and data storage/retrieval.



► be cleared and the cursor will appear in the upper left corner of the cleared area.

Editing allows any routine calling the CHIN subroutine to edit any line on the screen and have that edited line passed back to the calling routine. Several commands are available in the edit mode to move and replace the characters on the line.

The edit mode is entered by either a Ctrl U (which also moves the

cursor up) or a Ctrl D (which also moves the cursor down). At this instant and until either a CR or LF is entered the user is in edit mode (signified by a blinking cursor).

We can't cover it all here, but if you have a 2650-based micro, the ETI-685 S100 board for example, then full details are available from Laurie Gellatly, 8th Floor, Carlton House, 55 Elizabeth St, Sydney. (02)232-6366.

Low power Z80

Zilog has announced a family of low-power versions of the Z80 micro, called the Z80L, said to rival CMOS micros, such as National's NSC800, with its low current operation and low cost.

The Z80L is claimed to be very well suited to battery back-up applications, and is being offered in three different speed ranges: 1 MHz, 1.5 MHz and 2.5 MHz.

The devices operate over a temperature range of 0-70°C and will be available in either plastic or ceramic packs. The CPU, SIO, CTC and PIO will be offered in the 'L' version but the DMA will not. The current consumption of a 1 MHz Z80L (ZL8400PS) is 15 mA at 25°C.

Production quantities will become available progressively through 1982 via the Zilog distributor, George Brown Electronics Group. (George Brown & Co, Browntronics and Protronics).

SME Systems

Announces the
powerful,
versatile
SBC800
Single Board Computer

This Australian designed and built S100 Z80 SBC has everything necessary for a stand-alone processor, and extra facilities that make it the most versatile board available today.

The two Serial I/O ports may be modems, terminals or printers—operating independently.

The two Parallel I/O interfaces provide a Centronics port and 22 general purpose I/O lines. Provision is made for a further 16K of EPROM or 6K of CMOS Static RAM.

The on-board rechargeable battery powers the real-time clock and the CMOS Static Memory.

Check these features against other boards:

- S100 Bus compatible
- Z80 CPU at 4 MHz
- Two Serial RS232 ports
- Centronics printer port
- 22 Programmable I/O lines
- Real Time Clock
- 2K CMOS RAM (& 6K option)
- Power on reset/Power fail detect
- Power on Jump to Monitor/Bios
- On-board memory disable
- 4K Monitor/Bios option
- On-board battery
- PRICE \$495.00 (exc. tax)

SME SYSTEMS

22 Queen Street, Mitcham,
Melbourne, Australia, 3132
Phone: (03) 874 3666
Telex: SMELEC AA37213

magmedia magmedia

Verbatim Datalife

Means 7 data-shielding improvements
for greater durability, longer life

World's largest manufacturer of quality Digital Recording Media. Supplying the broadest range of Diskettes and Mini Diskettes, Cassettes and Mini Cassettes, Cartridges and Mini Cartridges for scientific, business and personal computer applications.

All Verbatim Media sets industry standards for long-life, error-free data storage, now with Datalife.

That's why Verbatim storage media is the choice of leading manufacturers of Digital Systems. Now it's available to you when you put your data into storage you get it back Verbatim!!

Now a comprehensive manufacturing operation is located in Melbourne, Australia. Complete laboratory and QC test facilities are available to provide customer service and testing for most Verbatim products.



Complete range available
Verbatim 8" Flexible Disks
Verbatim Cassettes
Verbatim Data Cartridges
Verbatim Optima Series Alignment
Diskettes
Verbatim 5¼" Mini Disks
Verbatim Mini Cassettes
Verbatim Mini Data Cartridges
Verbatim Test Instruments

Sole Australian distributor



magmedia

Magmedia service puts the customer first

SYDNEY: 5 Apollo Place Lane Cove NSW 2066
Phone (02) 428 1100 Telex AA22703

MELBOURNE: 100 Park Street South Melbourne
Phone (03) 699 9688 Telex AA35968

BRISBANE: 123 Leichhardt Street Brisbane
QLD 4000 Phone (07) 229 1941 Telex AA42367

CANBERRA: 25 Lonsdale Street Braddon
ACT 2601 Phone (062) 48 6751 Telex AA22703

NEW

2650 MONITOR G BUG

FOR ETI 640 VDU'S
OFFERS

FAST SCREEN
EDITING

QUICK FLICKER
FREE SCROLLING

EXTRA EXTENDED
CONTROL CHARACTERS

PARALLEL KEYBOARDS
INPUT OPTIONAL

EXTRA COMMANDS

Supplied in 2K
Eprom with
documentation.

See news item
Pg.67 this issue

PRICE
\$40

Post Paid

L. GELLATLY

8th Floor,
55 Elizabeth St.,
Sydney, 2000

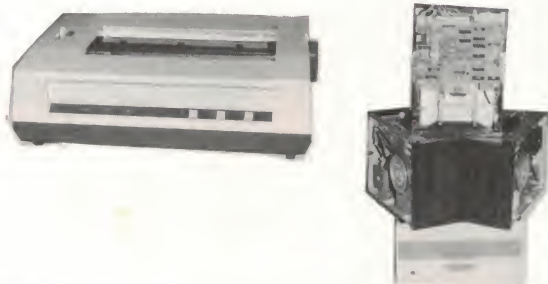
COMPUTER SALE – COMPUTER SALE – COMPUTER SALE – COMPUTER SALE – COMPUTER SALE –

Plus Sales Tax

DISC DRIVES

MPI 51	.....	\$275.00	+	17.5%	S.T.
MPI 52	.....	\$385.00	+	17.5%	S.T.
MPI 91	.....	\$415.00	+	17.5%	S.T.
MPI 92	.....	\$515.00	+	17.5%	S.T.

TM100-1	\$295.00	+	17.5%	S.T.
TM100-2	\$385.00	+	17.5%	S.T.
TM100-3	\$415.00	+	17.5%	S.T.
TM100-4	\$515.00	+	17.5%	S.T.



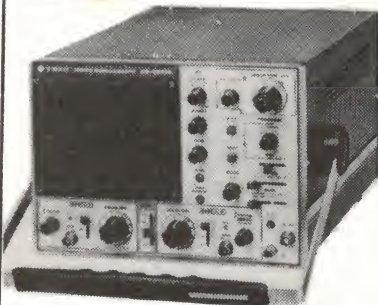
8" Double Sided Double density \$625.00 + S.T.
Please Note: We have many different types of
connectors available for computers.

8" Soft Sector	10 for \$43.00
5" Soft Sector	10 for \$41.00

CPM SOFTWARE-WORDSTAR \$495.00
COMPLETE CPM 2.2 SYSTEMS

**FROM ONLY \$2950
+ Tax**

Remember this is assembled and tested.
It has a 90 day warranty so why not buy a
REAL SYSTEM



Model	Screen Size	Bandwidth	Sensitivity	Sweep Time	Trace	ALL PRICES Plus 17½% Sales Tax
CO-1303D	75mm	DC- 5MHz	10MV/DIV.	—	Single	\$ 219.00
CO-1303G	75mm	DC- 5MHz	10MV/DIV	—	Single	\$ 264.00
CS-1559A	130mm	DC-10MHz	10MV/DIV	1uS/DIV .5S/DIV	Single	\$ 448.00
CS-156AMKII	130mm	DC-15MHz	10MV/DIV	.5uS/DIV .5S/DIV	Dual	\$ 498.00
CS-1562A	130mm	DC-10MHz	10MV/DIV	1uS/DIV .5uS/DIV	Dual	\$ 528.00
CS-1566	130mm	DC-20MHz	5MV/DIV	.5uS/DIV .5uS/DIV	Dual	\$ 645.00
CS-1572	130mm	DC-30MHz	5MV/DIV	.2uS/DIV .5S/DIV	Dual	\$ 929.00
JS-1575	130mm	DC- 5MHz	1MV/DIV	.5uS/DIV 2MS/DIV	Dual	\$ 537.00
CS-1577	130mm	DC-35MHz	2MV/DIV	1uS/DIV .5S/DIV	Dual	\$ 983.00
CS-1830	130mm	DC-35MHz	2MV/DIV	.2uS/DIV .5S/DIV	Dual	\$1163.00

MINIMUM P&P \$2.00

Bankcard Mail Orders Welcome
Please debit my Bankcard

Bankcard No.

Expiry Date

Name

Signature

425 HIGH STREET, NORTHCOTE, VIC. 3070
(03) 481 1923, (03) 489 7099. P.O. BOX 235

Computer interface for Olivettis

Inca Data Systems has available STOL communications interfaces which provide RS232C facilities enabling Olivetti Model ET221 electronic typewriters to be connected as letter-quality printers to such microcomputers as Apple, Tandy, National Panasonic, Durango, Zenith and Hewlett-Packard. The advantage is of course that the ET221 may be used as a stand-alone typewriter when not printing.

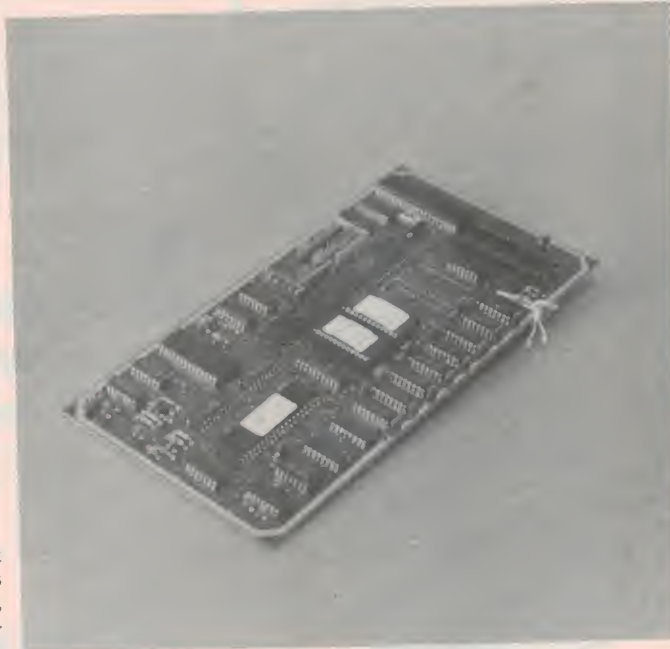
Through logical, two-character commands the operator of the host computer may call up many of the print features of the Olivetti ET221, such as proportional spacing, decimal tabulation, automatic centring, reverse image and automatic underlining.

The STOL interface also enables the ET221 to act as an interactive terminal. As a demonstration, Inca connected a STOL/ET221 to the Source database in the USA by means of the Midas communications facility, made a number of on-line enquiries and stored the data for future recall. With the pend-

ing introduction of an Australian Source data network the STOL/ET221 combination could provide all the necessary terminal functions plus letter-quality printing.

The STOL interface is available now for immediate delivery, and may be fitted to both new Olivetti ET221s or to units already in use. Inca provides service on a national basis.

For further information contact Mike McLaren, Inca Data Systems Pty Ltd, 2nd Floor, 10 Help St, Chatswood NSW 2067. (02)411-7844.



CHIP-8 intelligence — how to get it

ETI-660 owners will be interested to know that a Melbourne software supplier has a range of CHIP-8 programs available that really show what the language can do.

'Dreamcards', as this business is called, claim that their software moves away from the traditional graphics orientation of most CHIP-8 programs to feature high-order intelligence.

Their present range comprises three software packages: 'Rummy' and 'Strip Jack Naked' (2K; \$15 for

cassette and instructions), 'Pon-ton' (4K — \$25 for cassette and instructions), and 'The Professor' (a 2K maths teaching program for children - \$17.50 for cassette and instructions).

The Software was originally written for the 'Dream 6800' computer, so a few minor modifications are

required to allow it to run on the ETI-660 because of its extra 'tone' and 'colour' features. 'Dreamcards' tell us that they are happy to assist anyone who has problems with this, but say that the high quality and considerable detail of their material should make difficulties unlikely.

If you have built the ETI-660 you will find these programs contain a wealth of information on how to get the best out of CHIP-8. For further information contact Lindsay Ford of 'Dreamcards', 8 Highland Court, Eltham North Vic. 3095. (03)439-4467 (ah).

Short computer graphics course at NSW Uni

The University of New South Wales will be conducting two special week-long intensive short courses on 'Elements of Computer Graphics'. The course will be of interest to mechanical, industrial, electrical, civil or aeronautical engineers involved in design work.

Computer graphics has become an essential element in solving the complex design and analysis tasks which face engineers each day. The course aims to build on their basic knowledge of computer graphics and develop their understanding of the concepts involved.

The course is interactive and will involve 'hands on' problem solving using Tektronix computer graphics systems, as well as a complete series of seminars conducted by Dr. David F. Rogers. Dr. Rogers is Professor of Aerospace Engineering at the US Naval Academy and he developed its computer-aided design/interactive graphics facility. He has

taught courses in CAD/CAM and interactive graphics for many years.

Attendance will be limited, and intending participants are advised to book early.

Course times will be as follows:

- Course #1: Monday July 5 — Friday July 9 1982 (9 am — 5 pm)
- Course #2: Monday July 12 — Friday July 16 1982 (9 am — 5 pm).

For further information contact Associate Professor R.D. Archer, School of Mechanical and Industrial Engineering, University of New South Wales, Kensington NSW 2033. (02)662-3720.

Software Source

89 OXFORD ST., BOND JUNCTION
PH: (02) 389 6388 P.O. BOX 364, EDGECLIFF 2027

SOFTWARE AND PERIPHERALS FOR THE SORCERER

WRITE FOR FREE CATALOGUE

CASIO® TOP NAME TOP VALUE

* TAX FREE PRICES:

These prices are applicable to bona-fide students, etc. who can supply the necessary tax exemption form signed by their school or college. Enquire at any Dick Smith store

Printer unit

Add-on printer unit for FX-602P, for storing data, programs, etc. in hard copy form

Cat Q-3127

\$126.50

TAX FREE
\$114.95*



Casio FX-602P Advanced Programmable

- 88 memories, up to 512 steps
- Full memory retention
- Full alpha-numeric LCD display

10 segment non-volatile 512 step program • Convenient users function • Variable Data Memory expanded as needed • 33 parenthetical levels in complete formulas • Password function to protect programs • Ultra high speed calculation • 50 kinds of algebraic function (all programmable) • 10 kinds of jump commands • Up to 9 subroutines & nesting possible • Battery life over 650 hours, auto shut-off • Thin, light weight • Powerful!

NEW FOR 82

Cat Q-3110

\$198.95



TAX FREE
\$181.24*

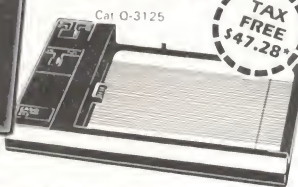
Cassette Interface

Store data, programs, results, etc. on a standard cassette recorder with this interface unit. Matches FX-602P

\$51.90

Cat Q-3125

TAX FREE
\$47.28*



Casio FX-3600P Scientific/Programmable

A superb addition to our range. This Casio FX3600P scientific calculator has the added advantage of simple programmability, plus integrals! It has up to 38 steps programming capacity, with integrals, regression analysis and 7 memories. It's the ideal calculator for tech & university students (and advanced high school students), engineers, technicians, laboratory workers, etc. with a 10 digit mantissa and two digit exponent, it's ready to handle just about anything you can give it! Liquid crystal display, with up to 1300 hours battery life. Comes with wallet and instructions.

TAX FREE
\$48.60*

Cat Q-3105

\$53.50

NEW FOR 82

The last word in pocket calculators...

QUALITY COMPUTER PRINTERS

INCREDIBLE BARGAIN! UNDER \$500 PRINTER!

Superb dot-matrix printer that uses ordinary fan-fold sprocketed paper up to 204mm wide. Its most unusual feature is the single hammer print-head — this means very few moving parts for increased reliability. Fitted with a standard Centronics type parallel data interface making it compatible with most modern computers.

X-3252

\$399 SAVE \$96.00!

OUR BIGGEST SELLER! ITHON 8300P DOT MATRIX PRINTER

The Ithon 8300P features high speed, bi-directional printing (125 characters per second), with full upper and lower case character set. It accepts standard fan-fold sprocketed paper up to 240mm wide. This means you can do 80, 40 or 132 column printing. Fitted with standard Centronics type parallel port. A great seller with great features.

X-3255

\$799 SAVE \$121.00!

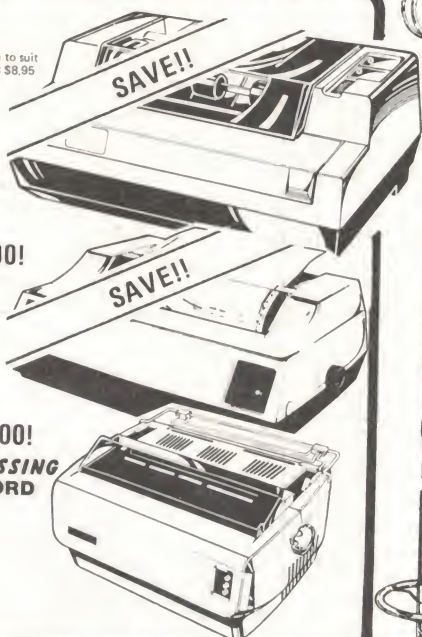
AND FOR SUPERB WORD-PROCESSING DICK SMITH DAISY WHEEL WORD PROCESSOR PRINTER

The Dick Smith Daisy Wheel printer delivers ultra sharp copy which is a definite prerequisite for word processing. It will accept standard office stationery or continuous stationery up to 400mm wide, if required. The cartridge ribbon and economical Diablo fonts are freely available making this a very versatile printer.

X-3265

\$1,995

Ribbon to suit X-3253 \$8.95



27MHz HIGH GAIN BASE ANTENNA

The Swamper is the easiest antenna to erect just pull it up and lock it. It has a high gain—3.75dB and no ground plane is required. It will withstand very high winds up to 130 km/hr. The base of the antenna is at DC ground potential. Included with your antenna is a 15m roll of co-ax with a PL-259 plug fitted — this alone is worth over \$10!!

If you are setting up a base station then get yourself a Swamper

ONLY \$79

D-4428

SIGNAL INJECTOR

One of the handiest devices to have in your tool box. Check out both audio and RF circuits (harmonics extend to many MHz) simply and easily. Often the quickest method of fault finding (and one of the cheapest!) Self contained, battery operated with probe and earth clip.

Cat Q-1270

\$7.50

AUDIO GENERATOR

TRIO AG-202A

The AG-202 is a Wien bridge CR-type, sine and square wave audio signal generator. All solid state in construction, it produces excellent sine waves instantly with a minimum of distortion and square waves with fast rise time.

Frequency ranges: 20Hz to 200kHz in 4 ranges
Frequency accuracy: +/-3%
Sine wave characteristics:
Output voltage: 10V rms +/-10%
Distortion: 0.5% at 50Hz to 100kHz
1% at 20Hz to 200kHz
Square wave characteristics:
Output voltage: 10V p-p
Overshoot: 3%
Sag: 10% at 20Hz
Output impedance: 600 ohms
Output attenuation: High/Low (40dB) & variable control (+/-10% variation)
Drift with line voltage: Freq +/-0.5% Level +/-0.5 dB
External synchronization:
Synchronization voltage: 1V/V approximately
Maximum input voltage: 3V rms
Input impedance: 10k ohms

Cat. Q-1220

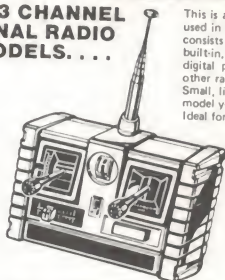
\$175.00



THE DICK SMITH 3 CHANNEL DIGI-PROPORTIONAL RADIO CONTROL FOR MODELS...

SAVE \$20.00!

Y-1230



This is a 3 channel digital proportional radio control unit that can be used in boats, planes and cars (models of course!) The complete outfit consists of the miniature receiver with plug sockets for the servos etc., built-in, wiring harness with battery holder and ON/OFF switch, 3 digital pulse position servos, transmitter with coloured flag to let other radio control users know what channel frequency you are using. Small, lightweight and above all else great fun to use when it is in the model you have built. Ideal for anyone who wants to be involved in a great hobby.

value \$79

PUT A RADIO IN YOUR CAR, BOAT OR PLANE

WAS \$249.00!

only sinclair ZX81
ONLY \$239.00!
PERSONAL COMPUTER

1 1K-byte RAM expandable 1 Cassette SAVE and LOAD with named programs 1 Up to 26 FOR/NEXT loops 1 Multi-dimensional string and numerical arrays 1 Graph drawing and animated display facilities 1 A unique chip that replaces 18 ZX80 chips 1 One key entry of many of the more usual entries such as LIST and PRINT 1 plus many more advanced features.

X-5000

Top Name TEAC at a DICK SMITH Price!



DOLBY SYSTEM

A-3505 and METAL!

Enjoy the benefits of metal tape facility
TEAC METAL TAPE DECK Model V-30

The TEAC V-30 stereo Dolby cassette deck offers some superb features: tape bias and equalisation switching, "brilliance switch" — provides 2 to 3dB boost in the high and middle frequencies, "peak level display", "record input level controls plus lots more — get one today and improve your stereo system!!

\$169.00

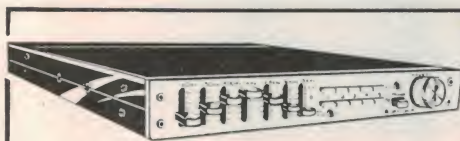
NEW FOR 82

Quality Turntable from TEAC

The TEAC belt drive turntable model P-50 comes complete with a magnetic cartridge mounted on a lightweight arm. The arm has anti-skating for accurate tracking of records. The unit is semi-automatic which means the arm will return to rest after a record has been played. The whole unit is present in a superb gun metal finish. Live with today's Hi-Fi — TEAC.

\$169.00 A-3079

OUTSTANDING VALUE



GREAT SOUND — GREAT VALUE!

CAR EQUALISER/BOOSTER

The latest slim line car graphic equaliser/booster. It has seven bands so that you can control the amount of boost or cut on the more important frequencies. The VU readout is via green LEDs for direct indication of level. The smart brushed silver type front panel blends in well with most cars. There is also a front to rear fader for use with four speaker systems. Power is boosted to 25 watts.

A-6666 \$69.95

HI-RESOLUTION GREEN VIDEO MONITOR
When using a computer with a monitor over a period of time you must invest in a high resolution green monitor. The high resolution combined with the green colour enables you to avoid eye strain and aids in the better understanding of what is actually on the screen. Why pay \$419 or more when you can get one from Dick Smith for far less.

X-1200

ONLY \$349

GREAT VALUE!



CONSTANT VOLTAGE TRANSFORMER

For all of you computer enthusiasts who have suffered the disastrous effects of program drop-out or worse due to fluctuating voltages — worry no more! This transformer will maintain a constant voltage to your equipment even when the mains voltage plays "yo-yo's". Essential for the serious enthusiast.

M-9851 ONLY \$195

CLOCK/THERMOMETER MODULE

A complete clock/thermometer module for the experimenter. With this module you will be able to tell the time and also the temperature. This is the module that is incorporated in our kit K-3436 — build the kit or buy the module to do your own thing.

Y-1053 ONLY \$34.50

4½ DIGIT LCD DISPLAY

Large 4½ digit LCD display that can be incorporated into any of your projects that demand a digital read-out. Why pay a fortune for others when Dick Smith has just what you want for just the right price.

Z-4175 ONLY \$8.95

REFERENCE DATA FOR RADIO ENGINEERS

Over 1100 pages of data for the Radio Engineer with 45 chapters, hundreds of charts, nomograms, diagrams, curves, tables etc. This beautifully bound book deserves a place on your bookshelf — but it will not gather dust!!!

B-1104 ONLY \$28.00

NOW IN STOCK!

CAR ALARM KIT MARK II
At last! This sought after kit is now available. Quality components and parts at a great price!
Cat. K-3253 **\$28.50**

LOOK AT THESE WORLD CLOCKS

LCD WORLD CLOCK



Great value for Radio Hams, International businessmen, Telephonists or anyone who wants to know the time anywhere in the world. This handsome desk-top World Clock has liquid crystal display and an easy to read scale dial. Functions: Month, date, hours, minutes and seconds. It also has a timekeeping function which is great for timing those costly overseas phone calls. Powered by one miniature silver oxide battery it gives you over a years use.

\$19.95

24 HOUR QUARTZ WORLD CLOCK

This is a fantastic addition to the Yaesu range: the new 24 hour Ham Clock. It shows the time all over the world at a glance. Its ideal for keeping those sheds. Uses one C cell (supplied) that should last for over one year.



Cat Y-1055

GREAT \$51 VALUE!

Cat Y-1051



WORLD TIME DUAL MELODY ALARM \$64.95

Now you can tell the time anywhere in the world! This fantastic new watch not only displays the local time but the time in 20 different time zones. The time is digitally displayed as well graphically — it actually has a diagram of the world!

This attractive quartz accuracy LCD World Watch will surprise you with its features:
• Dual melody alarm — home time and world time alarms
• LCD display which shows the date, alarm, home time and 20 different world times
• World graphic display
• Night light
Great for the businessman, amateur radio operator or anyone who needs to know the time around the world!

PUSH BUTTON DIALLER ONLY \$27.00

Converts rotary dial phones to push button type. Ideal for hobby use or private phone systems. Memory re-dial allows a previously pressed of a button. 16 digits can be retained in the memory.
SPECIAL NOTE: Although these fit perfectly into standard Australian phones (no soldering required) present regulations do not permit them to be used for this purpose.



Y-1175 WITH MEMORY

SOLAR CELL

Why not call in and see the very latest Solar Cells from Dick Smith. Marvel in the knowledge of "Free Power" and use this free power to experiment with. High output of around 450mV makes them ideal for joining together to produce either higher voltages or higher currents.

\$2.95 Z-4835

RADIO HAM'S 1982

The 1982 Radio Amateur's Handbook is bigger and better than the 1981 edition. Each year this book comes from ARRL with the latest techniques and methods for the radio amateur and it has become the standard bible for all amateurs. Get yours now as there is always a great demand for this book.

B-2219 \$19.95

CASIO ORGAN/CALCULATOR

The Casio Organ/Calculator is no larger than some so called pocket calculators but as well as being a superb calculator it also has a keyboard, plus built-in rhythm generator, memory store of keyed notes and then replay, provision for external power and connection to your stereo/mono amplifier for that big sound play-back!! It really is a marvel of modern technology and has to be seen to be believed. Call in now and play your favourite melody or make one up as you go along with this fantastic instrument come calculator.

THE CALCULATING ORGAN FROM CASIO

\$89.95

Y-1156

LCD WATCH MODULE

Ideal for all experimenters — hundreds of uses!

Here it is — the insides of a liquid crystal watch — the complete module including battery. Quartz controlled for accuracy and with liquid crystal display. This unit can be used to make your own watch, set it in the dash of your car, or even mount it in some form of jewellery for a fascinating and unusual timepiece.
Cat Y-1039

NEW LOW PRICE \$6.45 DOWN TO HALF PRICE



DICK SMITH Electronics

SEE OUR OTHER ADS FOR ADDRESS AND SERVICE DETAILS

1982/83 CATALOGUE AVAILABLE FREE IN THIS ISSUE!



DSE/A210



Disks, CP/M and your computer

Disks aren't just super-fast cassettes — they change the whole personality of your computer. It's also important to know a bit about a disk operating system, like CP/M, **before** you buy.

Graham Wideman

BY THIS TIME in history, it's possible that anyone the slightest bit interested in buying a personal computer is already familiar with how a computer can be programmed in BASIC, and how programs and data can be stored on cassettes. However, there seems to be a barrier of mystery surrounding the matter of disks and disk operating systems, tending to make the beginning computer enthusiast regard them as subjects of advanced study, to be taken on far in the future. At best, disk systems are looked upon as an extension of what the inexperienced already understands, in other words as 'super-cassette' storage devices.

This state of affairs is a great shame, since it far underestimates the true

worth of a disk-augmented computer system, and in addition precludes the computer purchaser from making the best possible decisions. This article aims to clear away some of this mystery, and to give a philosophical feel for what a disk means to a computer system.

A shift of emphasis

There is an understandable feeling among users of simple cassette-based computer systems that the object of the user's attention is the 'program'. This program can be written, debugged and run, and then saved on cassette, later to be loaded and run again. If data is generated by the program, it is usually displayed immediately on the screen, or may with varying degrees of difficulty be saved on the cassette. This data is

almost looked upon as a nuisance if it must be saved for later, such as in a cheque-book balancing program.

In a computer system with disks the emphasis changes radically. The centre of attention is now an entity known as a 'file'. A file is a bunch of data which spends most of its time stored on the disk (this data actually might be a program, or text, or numbers). A typical activity involves first loading from disk a file which is a program. This program automatically starts, and is used as a tool to operate upon other files on the same or other disks. By 'operate on' I mean that the file is loaded in, the program does something to it, and then at the end of a session the changed file is put back on the disk.

As a specific example, suppose file 1 is a program which conveniently allows text to be entered from the keyboard or disk, and gives a pretty display on the screen. It might also allow the text to be modified with great ease. In short, a word processor program. File 2 might be a story that has been half finished by the author.

A session might proceed as follows. Author loads file 1. File 1, being a program, starts to execute, asking questions of the author. Author gives the responses that indicate he wants to work on the story contained in file 2. So the word processor program loads file 2 into memory, displays the desired portion of it, and for the rest of the afternoon the author uses the word processor as a tool to modify and add to the text. Ultimately, he gives the command to save the modified text on the disk. Now file 2 contains the modified text. Later, if the author is satisfied with the text he can load file 3, which we shall say is a program whose purpose is to take the text in a file and send it to a printer. The file 3 program is asked by the author to print out file 2. And so on.

Again, the emphasis is very much on the file as the centre of attention. Almost every operation that is performed by the operator involves getting files off or putting files onto the disk, with some processing in between. This shift of emphasis is hardly surprising given the vastly increased speed and reliability of the disk storage mechanism over the cassette. And it is an orientation suited to work; you start with something (or even nothing), you do some work on it, and then you save it.

Disk operating systems

If your computer has no disks, then the 'personality' which talks to you is the power-on-monitor, or BASIC. Which ever one it is there are certain words your computer talks to you with, and words you can use to talk to it. In BASIC you can say things like LIST or RUN or start entering lines of program. A computer with disks must have a new personality, one which allows you to interact with the disks. In this personality you are typically equipped with words which allow you to select a specific disk drive (if there is more than one), to get a readout of the contents of the disk inserted in that drive, to load a file, and so on. This personality is called the 'disk operating system' — the system by which the disks are operated.

In fact what has really happened is that your computer is now a whole new machine. Although disk operating systems or 'DOSs' are not the most straightforward subjects, and tend to have rather cryptic words, the study of one of the most popular will prove to be

of great use when shopping, or developing your knowledge of computers. On then to look at CP/M.

What's CP/M

CP/M, standing for 'Control Program/Micro' (so what?), was developed by Digital Research Corp., principally for use with the Intel MDS 800 system, which you've probably never heard of. However, a lot of people liked the way it worked and adopted it for their computer products, so now it's really widespread. In any case, let's see what it does for your machine.

Two major aspects of CP/M are important to discuss. The first is the personality it gives your computer, the things it allows you to do, the ways it lets you talk to your computer and disks. The second is the fact that with CP/M your computer becomes a 'standard' CP/M computer, not only in the way it interfaces to you (the words you use) but in the way other programs you might buy or trade act with your computer. If your bought or traded program has to output to the screen, it sends its characters to CP/M, which, having been set up for your machine, knows how to send characters to your screen.

CP/M's personality

The first thing that any good operating system should do is to allow you to call files by name. In other words you shouldn't have to locate data or programs by specifying what track and sector they are stored at. You shouldn't even have to know their length. So CP/M allows you to name files with a two-part name like FRED.TXT. CP/M keeps track of where the file FRED.TXT is on the disk, using a list called the 'directory.' The part of the name preceding the period can be up to eight letters, numbers or symbols, and the part after up to three. By convention, the first part of the name is called the 'filename,' and the second part is known as the 'filetype', 'extension' or 'typ', although only in a few cases is the filetype of any special significance.

CP/M has several built-in commands. These include DIR, which you would type if you want a listing of the directory, so you know what's on that disk; ERA to erase a file; REN which allows you to rename a file, and a few others.

Most of the exciting work takes place if you load a program. If you name a program file with the extension 'COM', then CP/M recognises the filename as a command. In other words, if I called my word processor file 'WP.COM', later I can type 'WP' and CP/M will get WP.COM off the disk, and immediately start running that program. Such non-built-in commands (which you and I think of as programs) are termed in CP/M

MP/M

MP/M is an operating system somewhat similar to CP/M (and in fact fully compatible with CP/M). The difference is that it allows more than one user to access the system at the same time.

This doesn't only mean more than one person using a machine — it means that even a single user can speed throughput by, for example, 'spooling' printout. This means that while you are printing one file you can be doing something else at the same time.

Not only does MP/M allow multi-user support, it can also be given tasks to perform at particular times (MP/M is 'aware' of the time). This means that, in large systems, a program can be entered once which will 'back up' all system files at three in the morning every morning, without operator intervention.

MP/M is really the last link in the chain — it holds almost all the features that up to now have separated domestic computers from 'main-frames'.

'transient commands' because they are not always in memory, just when you ask for them.

CP/M comes with an assortment of such transient commands or programs, a program for copying files, a rudimentary (very) editor, an 8080 assembler and various necessary utilities.

Some work with CP/M

As an exercise in familiarisation with working with disks, let's suppose we want to write a machine language program using the assembler. For the sake of the example the 'program' will be extremely simple, just a jump to location 0 in memory.

First we decided on a name for the assembly language text file ... say EXAMPLE.ASM (the .ASM typ is necessary, as we shall see). So now we type:

```
ED EXAMPLE.ASM
```

This calls the program ED (file ED.COM) and hands over to it the name EXAMPLE.ASM as the name of the file to be worked on. (I'm omitting the computer's prompts and simplifying somewhat, just to give the flavour of what's happening.) Then ED allows us to enter with its peculiar (very) commands the following text:

```
ORG 100H
JMP 0
END
```

Next we tell ED we're through, and ED stores the text with the file name EXAMPLE.ASM. On to assemble this program. We type:

```
ASM EXAMPLE
```

The program ASM (file ASM.COM) comes off the disk and executes, looking for the file EXAMPLE.ASM (must be '.ASM' or ASM won't work on it). Soon the screen tells us that ASM is through, and we can proceed. ASM has created another file, called EXAMPLE.HEX wherein are contained the op-codes specified by our assembly language

program. They are stored in what is called Intel Hex Format, which amongst other things stores both the bytes themselves and the addresses where they are supposed to go in memory. In this case we specified with the ORG 100H statement that the program was to originate (start) at location 100H, and this information is incorporated in the HEX file. The final step is to make an executable program file from this HEX file, for which we use the program LOAD:

LOAD EXAMPLE

This causes LOAD to come into memory, then bring in EXAMPLE.HEX (must be '.HEX' or LOAD won't work on it) and then LOAD makes a new file, EXAMPLE.COM, containing the actual raw machine code. Now if we type EXAMPLE, CP/M will get the file EXAMPLE.COM off the disk, and start to execute it, which of course won't be very exciting, since it's just a jump to 0H. But at least this shows how work is done.

Inside CP/M

We've just seen how CP/M allows you to work with your disk-computer system. But this is only the superficial half of the story. Let's look at the inside.

CP/M is a large program, or rather a large collection of routines. These you might imagine to have a 'central core', which dictates the procedures involved in CP/M operations. This is termed the BDOS or Basic Disk Operating System, and is the same for all CP/M programs (of the same version number) regardless of the computer they are running on. This BDOS interacts with the disk drives through a collection of routines which I'll call the Disk Input/Output System, or DIOS. This must of course attend to the details peculiar to the particular disk drives to be interfaced. As a consequence, you don't usually buy CP/M by itself, you buy it with the drives. The drive manufacturer will have contributed the DIOS routines.

But CP/M still has to talk to your computer's facilities, such as its screen and keyboard, or terminal, printer and possibly cassettes. The group of routines that take care of these functions are called the CBIOS, or Console Basic I/O System. If you are lucky, when you buy the drives, the manufacturer will have already written the appropriate routines for your computer; if not you'll have to write them, a somewhat tedious procedure since your keyboard and screen can't talk to CP/M until they are done. (So if you don't feel up to the task, check first!)

There are two other groups of routines that you'll encounter. The first is the last section of CP/M itself, the CCP or Console Command Processor, which

takes care of the procedures involved in the built-in commands you can give from the keyboard, such as the DIR-ectory listing. The other set of routines are those contained in the 'boot ROM'. Included with a CP/M disk package is a Read Only Memory, which is addressed at some otherwise unused spot in your computer's memory. It contains the routines to initially start loading routines from the disk after you turn on your computer. In order to start up your disks after turning on your machine, you 'escape' to the power-on monitor, and then order a jump to whatever the address of the ROM. The computer then follows the routines in the ROM which initialise the disk drives and then load a more sophisticated loader program, which then brings in the rest of the CP/M program collection and puts it in the appropriate area of your computer's memory.

The virtues of being standard

Since the central core of the CP/M program is common to all CP/M computers, all such outfits appear to the user to work the same way. The details of each computer are taken care of by routines which do not affect the interaction with the user. But perhaps more importantly, CP/M makes all CP/M computers look the same to programs which may be run, greatly facilitating the exchange of programs and data, widening the selection available to you. In order to do this, CP/M enforces or assumes certain requirements and conventions on the way things must be.

First there's the obvious one that CP/M is written in 8080 machine code, so only computers with 8080, 8085, or Z80 microprocessors will run it. This includes the Exidy Sorcerer, TRS-80 and Dick Smith System 80, most S100 computers, and even the Apple if equipped with the accessory Z-80 card, not to mention assorted other popular personal computers.

Secondly, CP/M uses some parts of memory for itself, and assumes that the user's programs will be in a particular location. Specifically, the CP/M program sits in the top approximately 8K of RAM. The bottom 'page' (0 to 0FFH) is used for housekeeping, remembering facts about the disks and files that are being accessed and so on. The user's programs (.COM files) are assumed to start at 100H, so that CP/M knows where to load them, and where to jump to, to automatically start execution.

The features which allow programs to use CP/M are the 'entry address' and calling conventions. If the user's program needs something done, whether it's output to the screen, input from keyboard, or interaction with the disks, a certain set procedure is used. The user

program loads a specific function code into the microprocessor's register C, and further parameters into registers D and E, and then does a CALL 0005H. Address 5 is already set up by CP/M as a jump to the CP/M program, which then looks at the information in registers C, D and E, and carries out the functions requested. Finally, control is returned to the user's program, and information if any from CP/M is passed again in registers D and E (this might be actual input from a keyboard, or a code indicating that a disk read was successful, etc).

Since all these conventions have been established, any program which follows these conventions can use your CP/M computer.

How standard is it?

If CP/M will run on your computer, you are virtually assured that any CP/M-based software will run successfully with it (some software does have special requirements, like certain minimum memory size). However, getting that software into your computer can be a different matter. There is a 'standard' CP/M disk format, which is 8" single-density 128 bytes per sector. However, this format is relatively unpopular with personal computer owners, who tend to prefer the 5.25" disk size, which is used with many different density and sectoring formats. As a consequence some software vendors are offering CP/M software in up to fifty different formats. If you are buying a 5.25" drive then it would be wise to see that the store has some kind of facility to copy software from 8" disks down to yours. Otherwise your software buying will be confined to those dealers who can afford to offer many formats, including yours. Folding an 8" floppy so you get it in the door of your 5.25" drive just won't do. (If you find somebody with the same computer and 8" drives, you can of course get the software into your machine via cassette, or serial port, so you won't be totally lost.)

CP/M or what?

CP/M is not the only operating system around, and certainly not the ultimate state of achievement. However, it is representative of operating systems you might encounter for a personal computer. The major attribute it has going for it is that there is a lot of software written for it. This in turn has made CP/M yet more widely used, and this popularity is likely to continue for some while, with newer releases of CP/M more appropriate for the market that has seized it. So if you are in the market for disk drives, or even a complete computer system, it is worth considering whether you'll have access to this vast and growing selection of software. ●

"BUGS"



Improve your FM reception or Video & Sound Tapes.

It is true the sound quality of FM radio is equal to anything you have ever heard on record or tape, and is far superior to the reproduction possible on AM radio. But this performance is largely dependant on level & quality of the signal fed into your FM tuner or video. In many cases you will face the same receiving problems you encounter with TV reception such as (Ghosting — Snow — Poor sound).

Regardless of how much you spend on your FM Tuner Amplifier or Video Cassette your equipment will only perform as well as your **Antennae System** will allow.

We at Electrocrafft knowing the problems of TV & FM reception can offer Free advice and a range of Antennae's & accessories to overcome these problems.

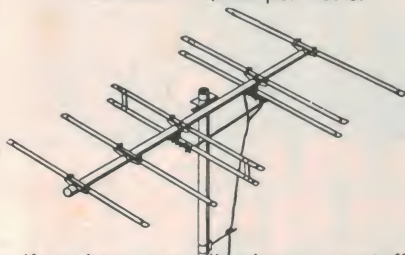
FM Antennae's

Hills FM1. Di-pole 300 Ohm
Hills FM3. 3EL 75 ohm
Hills 353. 3EL 300 ohm
Hills Do-it-yourself kit.
Channel-master 700FM 4EL 300 ohm
Matchmaster FMG2 300 ohm Semi fringe
Matchmaster FMG6 Super fringe

VHF Ch.0 to 11
UHF Ch.28 Band 4
UHF Ch.s 7-9-10 Band 5

We have over 50 types of Antennae's in stock plus Cables — Amplifiers — Brackets — Masts — & all accessories. With some of the cheapest prices in Sydney.

Aluminium tube 9.5 OD . . . 90¢ per metre
24.5 OD . . . \$3.80 per metre.



If you have recording bugs, our staff have the cure.

Free verbal advice.

ELECTROCRAFT PTY LTD

68 Whiting Street, Artarmon NSW
Telephone 438-4308
or 438-3266

WE ARE SPECIALISTS

30 years in the antenna business.
Hours: 8am to 5pm.

Prices subject to alteration without notice.

RADIO DESPATCH SERVICE

869 George Street,
Sydney, NSW. 2000.
(Near Harris Street)
Phone 211-0816, 211-0191.
WE ARE DISTRIBUTORS
FOR: — "INTERFIL"
INTEGRATED CIRCUITS

APRIL SPECIALS LIMITED QUANTITIES ONLY

Transformer Prim: 240v. sec = 120v @
20vA Type 5195\$4.50
Dual Power Supply Unit 250v Input:
Secondaries = +170v-170v.....\$5.00
Transformer Prim: 240v sec = 16.5 @
3.6A 11.5v @ 8A.....\$10.00
Multicoloured 37 core cable with alu-
minium foil shield and grey PVC HD
sheath.....\$2.45 metre
T/F/8 240v Brown PVC flex
cable.....\$0.20 metre
Universal Polarity checker type
CC 250.....\$2.00 each
Solder - mop desolder with light
gauge.....\$0.50 each
Top cowl 42" car aerial CA-30\$3.00 each
Jabel 3 pole — 2 position rotary
switch.....\$0.55 each
"Muffin" computer fan 240v.....\$20.00
"Ferguson" PL12/20vA/2 12v 20w
transformer.....\$4.00 each
"Panther" 13.8v/2A Power
supply.....\$26.50
Transistors BC 237 or
BC 238 ten for \$0.75
"Arco" S.P.S.T. black lever toggle
switch.....\$0.40 each
Slider switch 1 pole - 3 way, \$0.35 each
3m/m Red Led 1 of 13¢ 100 of = 7¢
LT 3215 Red Led array (5 Led
strip).....\$1.02 each
LT 3235 Green Led array (5 Led
Strip).....\$1.14 each
Jabel 1 pole - 6 position rotary
switch.....\$0.50 each

TEXAS CALCULATORS

	Ex/ Tax	Inc/ Tax
TI — 59	\$224.00	\$255.40
TI — 58c	\$135.00	\$152.36
TI — Pc100c		
Printer	\$205.00	\$231.50
TI — 55/II (New Model)	\$ 53.53	\$ 59.95
TI — 54 (New Model)	\$ 36.96	\$ 41.58
TI — 50	\$ 36.96	\$ 41.58
TI — 40 (New Model)	\$ 32.84	\$ 36.95
TI — 35	\$ 24.57	\$ 27.40
TI — 30/II	\$ 17.20	\$ 19.00
TI — Speak and Spell Learn aid	\$ 69.53	\$ 78.25
TI — Speak and Real Learn aid	\$ 83.09	\$ 93.49
TI — Speak and Maths Learn aid	\$ 74.29	\$ 83.64
TI — 58/59 Module Libraries	\$ 33.40	\$ 37.60
TP — 30250 PC — 100C Thermal Paper-3 roll pack	\$ 11.37	\$ 12.68

MIN. ORDER VALUE: \$10.00
STRICTLY CASH ONLY

OPEN: Mon-Fri 8 am to 5.30 pm.
Thursday night late shopping until
8.30 pm. Saturday 8 am to
11.45 am.

JIL SX-200, A BETTER SCANNING MONITOR RECEIVER.



Monitors over 33,000 frequencies from
26 to 88 MHz, 108 to 180 MHz and 380
to 514 MHz. Bands included within this
range are HF and UHF CB, 27 and 155
MHz MARINE, Australian LOW BAND,
AIRCRAFT band, VHF SATELLITE band,
10 Mx, 6 Mx, 2 Mx and 70CMx
AMATEUR BANDS, VHF High BAND as
well as UHF two-way band.

Mechanically rugged the SX-200 uses high
quality double-side Epoxy-Glass printed
circuit boards throughout. Some of its other
outstanding features include 3 MODE
SQUELCH circuitry which allows the
lockout of spurious and carrier only signals,
extremely low spurious count, AM and FM
detection on all bands, FINE TUNING
control for off channel stations, 240 VAC
on 12 Volt DC operation, Accurate
QUARTZ CLOCK, Squelch operated
OUTPUT for switching a tape recorder etc,
16 Memory channels, MEMORY BACKUP
which lasts up to two years, high
SENSITIVITY and SIGNAL-TO-NOISE
ratio on all bands, CRYSTAL FILTER for
excellent SELECTIVITY and easy
servicability due to component layout as
well as a 90 day warranty.

Its high quality and performance is testified
by the fact that it is in use by a large
number of State government and Federal
bodies including most state and federal
police departments.

Contact GFS, the Australian Distributors,
or our interstate outlets for full technical
specifications.

We also market a range of pocket scanning
receivers and transceivers.
Contact us for full details.

PRICE \$512 INCL S.T. + \$8 P&P
SERVICE MANUAL \$10 + \$1 P&P
SCAN-X BASE ANTENNA \$48 + \$8 P&P

Interstate Dealers:
WA: (09) 387 4966
NSW: (02) 211 0531
QLD: (07) 397 0808
SA: (08) 269 4744

GFS Electronic Imports

15 McKeon Road
Mitcham, 3132 Vic
TLX 38053 GFS
(03) 873 3939

At last - the no con

Do you want to build your own state of the art computer? Do you want a computer which can grow and expand with your changing needs? Then MicroBee is the answer.

MicroBee incorporates some of the most advanced technology available today. So it's not surprising that it has features not available on computers such as APPLE and TRS80; like built in sound and battery backup. And it comes standard with features that are supplied as options on these machines. Like upper/lower case, HiRes (512x256) programmable graphics and an RS232 port for printers and modems.

Superbly Expandable

Most personal Micros offer good value in their basic form, but let you down when it comes to expansion. This is where MicroBee is different. The top or 'Core' board of the MicroBee plugs in and offers tremendous expansion potential. As standard, you can have 32K RAM, 16K BASIC in ROM is standard and there is room for a further 12K of ROM (For the Monitor ROM and Networking ROM).

For people whose needs grow further, we have provided two things:-

YES! CP/M and S100

● All the Z80 CPU pins necessary have been brought out (see photo) to the rear of the Core Board. So your MicroBee can be interfaced with any of the S100 standards.

● In the near future, MicroBee owners will be able to have their machines factory upgraded (by the fitting of a modified Core board and other mods.) to 48K RAM/S100 running CP/M and disc drives. The programmable VDU chip in MicroBee allows the switch to 80x24 screen format.

MicroBee opens the doors to the massive library of CP/M software. MicroBee is the most forward thinking Micro you can buy today. It is your best starting point, wherever you want to go in personal computing. And it's still only \$399 in kit form.

YES! 16K ROM BASIC

MicroBee has been developed as the finest instructional computer on the market. Its superb 16K BASIC in ROM makes this possible. Whether you are a novice or advanced enthusiast, MicroWorld BASIC is a delight to use, with its advanced error reporting and powerful graphics facilities.

```
06000 REM This subroutine draws a square of lengths l1,l2
06005 REM with the bottom corner at a1,b1
06010 VAR(A1,B1,L1,L2)
06020 REM Draw left side, then top, then right, then bottom
06030 GOSUB [ A1,B1,A1,B1+L2 ] 4000
06040 GOSUB [ A1,B1+L2,A1+L1,B1+L2 ] 4000
06050 GOSUB [ A1+L1,B1+L2,A1+L1,B1 ] 4000
06060 GOSUB [ A1+L1,B1,A1,B1 ] 4000
06999 RETURN
65000 END
```



Portions of lines may also be underlined for another effect,

e.g. This procedure must be followed at all times.

or in case of special notation ...

$$r = a \cos(w) + b \sin(w)$$

The verb in this sentence is sum

YES! Continuous Memory is here

The use of the latest CMOS RAM chips, (6116), has made battery backup of memory possible. Just think, you can store a program or data in RAM, switch off, move to a new location and your program and data is still there.

FIRST PRODUCTION SELLS OUT IN 10 DAYS

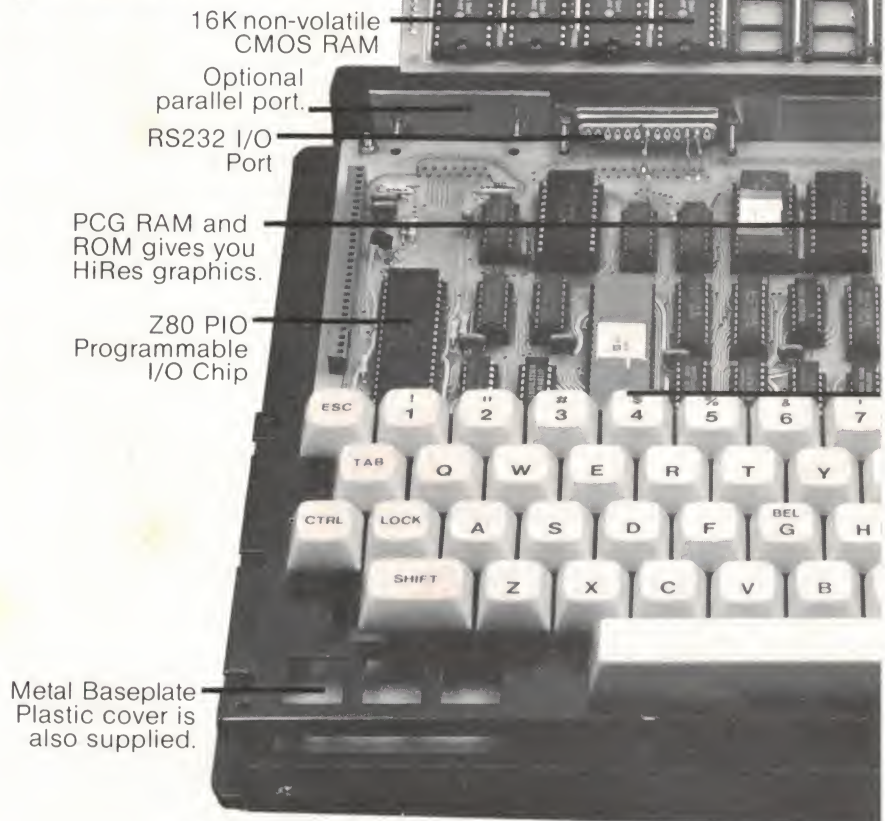
MicroBee looks like being Australia's most popular kit computer ever!! As you read this magazine, we are assembling the next run. So order now to avoid delay and disappointment.

If you want to learn more about MicroBee, then get us to send you a copy of our fantastic 'Ideas Book'. Its 32 pages are packed with information and applications software on MicroBee. Just send 50c to cover postage and packing and we'll get your ideas book to you today.

Complete Kit \$399



Includes manuals, case, 16K BASIC in ROM, Power Supply and IC sockets. This kit is complete.



promise kit computer

Software Growth

Being Z80 based, MicroBee has a huge software base. And it's one we're improving all the time. New releases include:-

Mini Word Processor/Assembler in ROM.

This great monitor not only lets you write machine language programmes, it also functions as a great little word processor. Functions include search and replace and edit. **\$49.50**

Cassette Software. The following programmes are supplied on cassette. All are \$6.95 each.

Pilot A very user friendly language. Especially good for writing computer aided instruction material.

Eliza The ultimate artificial intelligence



programme. Actually carries on meaningful conversation.

Target The computer screen becomes a battlefield covered with enemy aircraft.

Trek Take command of the USS Enterprise and destroy those nasty Klingons.



No Apologies Service Coupon

With our easy step-by-step assembly manual, solder masked PC boards and socketing throughout, assembly is very easy. If you do have any trouble, just fill in the NO APOLOGIES coupon with the \$50 service fee and we will finish building your MicroBee for you and return it to you.

FREE MEMBERSHIP

When you get your MicroBee, you gain free membership of the MicroWorld Users Group. You'll be kept fully informed of all software developments and ideas. We'll keep you and your MicroBee busy!

ORDER DETAILS

MicroBee with 16K RAM, 16K ROM BASIC and all manuals **\$399.00**

MicroBee as above but with 32K RAM **\$499.00**

16K to 32K RAM upgrade (changeover) **\$120.00**

Mini Word Processor /Assembler in ROMs with manual **\$49.50**

All Cassette software **each \$6.95**

Video Monitor **\$129.50**

Cassette Recorder **\$35.00**

Order Direct Save Time

To order your MicroBee, all you have to do is phone on our Hotline number, give your Bankcard number and name. We'll get the goods on their way to you.

**Hotline Number:-
(02) 487 2711**

**Mail Orders to
PO Box 311, Hornsby
2077.**



**APPLIED
TECHNOLOGY
PTY. LTD.**

**Showroom/Office at 1A Pattison
Ave. Waitara.**

Hours: 9-5 Monday to Saturday

Phone (02) 487 2711

Telex APPTEC AA72767

Full expansion capability. All Z80 pins are brought out for future growth.

Built in speaker. MicroBee gives you 2 octaves in semitone intervals. 1/4sec. intervals.

16K BASIC in ROM as standard

Power input, video output.

Cassette Interface. 300/1200 BAUD.

Battery Backup.

Z80A CPU gives you a massive software base.

VDU Generator gives upper/lower case.

Full function Keyboard.



How to score!

Here's a handy little software routine and two useful examples employing it. The article describes how to display a variable on the screen as two decimal digits — useful for scoring and other things.

Phil Cohen

THIS HANDY little number takes the value in the VD variable and puts it onto the screen as a two-digit decimal number. The top left position of the left-hand digit is set by variables VB and VC.

I've used this routine in two programs so far — the Reaction Timer and the Clock — and I'll probably use it again later.

Its usefulness stems from the fact that it's not too basic (for example, it automatically updates the value of VB so that the next thing you put on the screen is to the right of the numbers) but at the same time it's not too complex (I didn't include zero suppression, for example).

Choosing the level of complexity of a general-purpose routine is not easy (especially when you don't know what programs you're going to use it in), but you should give some thought to it.

The routine uses the V0, V1 and V2 variables and also the memory locations 0700 to 0702 — so the program that uses it should not make use of them.

It works like this: 0704 I=0700 sets the special-purpose I variable to the spare area at 0700. Then the useful M(I)=DECML VD statement takes the value in VD, translates it into a decimal number between 0 and 255 (which does all the work), and puts it in the memory locations starting at I (0700).

Statement 0708 takes the memory contents starting at I and puts them into variables V0, V1 and V2 — so V0 now holds the 'hundreds' digit, V1 the 'tens' and V2 the 'units'.

Now, for the reasons outlined above (about the complexity of general-purpose routines), I've limited this routine to two decimal digits (0 to 99), and so the 'hundreds' digit is not used. This means that if VD is over 99 (decimal), funny things will start to happen (try it and see).

All that remains now is to put the digits representing V1 and V2 on the screen. This is done using the useful I=DISPLY V1 function, which sets the value of the I variable so that it points to the area of ROM memory which holds the screen representation of the number in V1.

All that remains is to display the five bytes that are found at that location, and this is done by a SHOW 5 @ VB, VC.

The value of VB (which gives the horizontal position on the screen) is then updated by statement 0710 before the second digit is put on the screen.

The value of VB is increased *again* at the end of the routine, so that the main program doesn't have to worry about moving the position of its next output to take into account the fact that there are two digits on the screen it doesn't want to overwrite.

The example given simply sets up VB, VC and VD with reasonable values and calls the routine by means of the DO 0704 statement. This sends CHIP-8 to location 0704, where the routine starts.

TWO-DIGIT PRINT

0704	I=0700	A700
6	M(I)=DECML VD	FD33
8	V0:V2=M(I)	F265
A	I= DISPLY V1	F129
C	SHOW 5 @ VB, VC	DBC5
E	I=DISPLY V2	F229
0710	VB=VB+05	7B05
2	SHOW 5 @ VB, VC	DBC5
4	VB=VB+05	7B05
6	RETURN	00EE

EXAMPLE:

0600	VB=10	6B10
2	VC=10	6C10
3	VD=63	6D63
4	DO 0704	2704
6	MONITOR	0000

Routine to print the value of VD as a two-digit decimal number at location VB, VC. VB is incremented. V0, V1 and V2 are used by this routine. 0700 to 0702 are reserved for use by this routine.

When the routine is finished, the 00EE command at the end of it sends it back to the location after the one it was called from (in this case, it would go back to 0606).

At 0606, the calling program has a 0000, which transfers control back to the monitor program, and the effect is the same as pressing RESET.

Reaction Timer program

This little program is not only fun — it also shows the use of the 'two-digit print' routine.

If you're going to use this program, enter all the bytes shown here, and then also enter the two-digit print routine bytes (with the exception of the 'example' calling program given for the routine).

When you press '8' (which starts the program), the screen will clear and nothing will happen for between zero and about five seconds (this is a random delay, included so that you can't predict when the reaction testing will start — this will become clearer when you start to use the program).

At the end of the delay period, an exclamation mark '!' will appear at the left of the screen, and the tone will begin to sound. As soon as this happens, press any key from 0 to F (it doesn't matter which one). The tone will stop, and the screen will show a time in seconds and hundredths of a second, which is the time between the '!' appearing and you pressing a key.

The display should be two digits (showing seconds, with a maximum of about 2), then a colon ':', then another two digits, showing hundredths of a second. A normal score is about 00:20.

For reasons that will become apparent later, the display will only go up to 02:55 — but this should be plenty (unless you're too drunk to find the keys).

Reaction time can be used to measure the general alertness of a person — once you get the program working, try using it with your eyes shut (the tone will tell you when to press the key). By comparing your score with your eyes open, you can find out whether you respond faster to sound or visual stimulus.

Having done that, try it with some background noise, too. You should find that your response time to noise is much less when you are listening to music at the same time. What does that tell you about the life expectancy of people who cross the road while wearing one of those little portable cassette players?

REACTION TIMER

```

0600 I=06D0      A6D0
2  VB=00        6B00
4  VC=14        6C14
6  VO = RND AND FF COFF
8  TIME=VO      FO15
A  VO=TIME      FO07
C  SKIP IF VO=00 3000
E  GOTO 060A    160A
0610 SHOW 5 @ VB, VC DBC5
2  VA=FF        6AFF
4  TONE=VA      FA18
6  TIME=VA      FA15
8  VA=KEY       FA0A
A  TONE=VB      FB18
C  VA=TIME      FA07
E  VB=VB+10     7B10
0620 VD=00      6D00
2  V3=FF        63FF
4  V3=V3-VA     83A5
6  V3=V3+V3     8334
8  VA=64        6A64
A  V3=V3-VA     83A5
C  SKIP IF VF=01 3F01
E  GOTO 0634    1634
0630 VD=VD+01   7D01
2  GOTO 062A    162A
4  V3=V3+VA     83A4
6  DO 0704      2704
8  I=06D5      A6D5
A  SHOW 5 @ VB, VC DBC5
C  VB=VB+05     7B05
E  VD=V3        8D30
0640 DO 0704      2704
2  GOTO 0642    1642
THE FOLLOWING SHOULD ALSO BE
LOADED (THIS IS THE DATA FOR
THE '!' AND THE ':').
06D0 1010
2  1000
4  1000
6  4000
8  4000

```

A program to measure your reaction time — the time taken to respond (by pressing any key) to an exclamation mark appearing on the screen. The time is shown in seconds and hundredths of a second.

This program makes use of the 'two-digit print' routine, which should be loaded into locations 0704-0716.

How it works

The first few statements are involved in just setting up the initial conditions for the test.

I (the memory pointer) is set to 06D0, which is the position in memory where the '!' screen display resides.

VB and VC (which control screen position in all the output) are set to a position half-way down the left-hand side of the screen.

V0 is used to give the random delay at the start of the program. The V0 = RND AND FF statement sets V0 to a

random number between 0 and 255.

The TIME = V0 statement sets the timer to the value in V0. Immediately, the timer will begin to decrease in value at the rate of 50 per second, so that it will reach 0 at a maximum of 255/50 = 5 seconds after the start of the program.

Statements 0608, A, C and E form a 'loop' — something that you'll see again and again in programming. The first statement sets V0 to the current timer value (which, remember, is decreasing of its own accord all the time).

Statement 060C checks to see if the value in the timer has reached 0 yet (V0 is used to store the timer value because CHIP-8 does not have a statement which will test the value in the timer directly).

If the timer is still not 0, then the statement at 060E will send the machine back round the loop. This will go on until the value in the timer *does* reach 0. When this happens, the 060C statement will cause the machine to jump to 0610.

Statement 0610 puts the '!' on the screen, and the race is on!

VA is simply used at statement 0612 to store the value FF, which is loaded into TNE (thus turning the tone on), and also into TIME, setting the timer to FF.

Having done this, the machine will be sitting with the tone on, the '!' on the screen and the timer ticking away from FF.

Now the program (at statement 0618) asks for a key to be pressed. Here, we're not really interested in *which* key is pressed, but rather *when* it is pressed.

So the machine will sit at statement 0618 and wait for a key to be pressed. As soon as it is, the program will move on to the next statement. This is 061A, which sets the TONE to the value of VB (which just happens to be 0). This will stop the tone.

The value of the timer is stored in VA, so the response time is held in VA (and we don't have to worry about what the timer is doing any more). This response time will be given by the difference between the value in VA and FF, in fiftieths of a second.

At statement 061E, the value of VB is increased, so that what we next put on the screen (which will be the result) will not over-write the '!'.

Now at statement 0620, we can start to manipulate the value in VA so that we get two numbers — one the number of seconds and the other the number of hundredths.

First, we set VD at 00, then we set V3 to FF.

In order to understand fully the workings of the following part of the program, try setting out on a bit of paper the values in the variables used, and following through the section of program with a value in VA of 10 (hex),

changing the values written on the paper as they would change in the machine. I'll explain it too.

At statement 0624, we subtract FF from VA. So the value in V3 is now the difference between VA and FF. The value in V3 is now actually the number of fiftieths of a second that the reaction time took.

Now we have to make that into hundredths of a second, and the 0626 statement does that. What it says is 'take the value in V3, add it to the value in V3 and put the result into V3'. So in other words it's doubling the value in V3.

V3 now holds the number of hundredths of a second. Now we have to find out the number of seconds (because this is displayed separately). We can do this by subtracting 100 from the value in V3 and then checking whether the answer is below zero. By counting the number of times we can subtract 10 (decimal) *without* getting an answer below zero, we can determine how many hundreds are there.

As a first step, we set VA to 64 (hex), which is 100 decimal. That's done at statement 0628.

Then we subtract VA from V3. Now if the result of a subtraction is less than zero, VF (and always VF) is set to 00. So if the answer is still more than zero, statement 062C sends the machine to 0630, which adds 01 to VD and then sends it back round the loop to 062A to subtract *another* 100.

This will happen until the answer given by the subtraction is less than zero. By this time, VD will hold the number of times that we have gone round the loop (i.e. the number of hundreds). When the answer to 062A is *less* than zero, VF will be set to 00, the program will go straight through 062C to 062E, and this will send it to 0634.

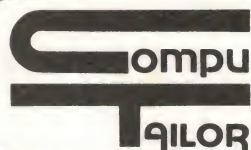
At 0634, 100 is added to V3 to bring it to the value it was at *before* the last subtraction (this will be the number of hundredths).

So by the time we get to 0634, VD will hold the number of seconds and V3 will hold the number of hundredths of a second.

0636 will send the program to the two-digit print routine (see earlier), and this will put the value of VD (whole seconds) onto the screen at VB, VC.

Then 0638 sets I to point to the screen image of a ':', which we loaded starting at location 06D5. 063A puts the colon onto the screen. 063C moves VB to the right so that the next two digits are in the right place, then 063E puts the value of V3 (hundredths) into VD, and 0640 causes it to be put onto the screen.

The last statement is a useful one to notice — 0642 GOTO 0642 will send the program into an endless loop (quite ▶



THE S-100 BUS MULTI USER EXPERT

NORMANBY CHAMBERS, 430 LITTLE COLLINS STREET, MELBOURNE, 3000

Telephone: (03) 602 3946

*We are skilled specialists in customized software and hardware computer systems.
We provide a generous guarantee, full maintenance and a satisfying back up service for all our customers.*

FULL SYSTEM

Z80A CPU, 64K RAM (200ns) bank selectable, RS-232C serial I/O, Parallel I/O. Two eight inch double-sided, double-density disk drives (2.4 MB storage). With CP/M 2.2

\$4150



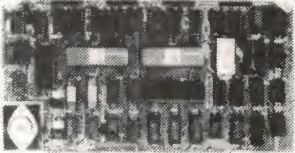

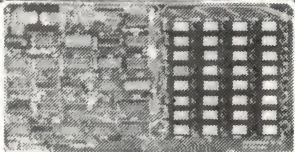


Options include MP/M II (2.0)

NOW AVAILABLE . . . CT-NOS

CT-NOS enables users of an MP/M system to have their own Z80A CPU and memory, without the need for expensive disk drives and printers.

Ring for further details.

S-100 BUS SINGLE/MULTI USER MICROCOMPUTER SINGLE BOARD GUIDE:

Number of boards per system.	Board	Features	UNIT COST A & T \$
	 <p>Any S100 Standard Board: Prom Programmers, A/D - D/A Converters, Expandoproms, Hard-Disk Controllers, General I/O Boards.</p>		
4 Boards for 16 User System.	 <p>MPC-4 Multi-Port Communicator</p>	Z80-CPU, Real Time Clock, Progr. Baud Rate Gen, 1K RAM (Static), 2 x Z80-Darts, 2K PROM (2716), Fifo Buffer, Z80-CTC.	\$680
1 Board for single or 16 User System.	 <p>VERSAFLOPPY II Floppy Disk Controller.</p>	2K Bios PROM (2716), IBM 3740 Standard Single Density or Double Density, Single or Double Sided Drives, 5 1/4" and/or 8" Drives, up to 4 Drives. Free: Computailor Bios PROM (2716).	\$465
1 Board for Single User, 8 Boards for 16 User System.	 <p>EXPANDORAM II Dynamic Ram Card</p>	Expandable Dynamic Memory 16K-256K, Selectable Boundaries, Up to 4MHz Operation, Phantom Output Disable, Page Mode Operation, Uses 16K (4116) or 64K (4164) Memory Devices.	16K—\$475 32K—\$510 48K—\$545 64K—\$580
1 Board for Single or Multi-User System.	 <p>VDB-8024 Video Display Board</p>	80 characters x 24 lines, 7 x 10 Matrix, Composite or TTL Video Output, Keyboard Power & Interface, Forward & Reverse Scrolling, Blinking, Underlining, Field Reverse, Field Protect and Combinations, Full Cursor Control, 96 Upper and Lower Case Characters, 32 Special Character Set, 128 Additional User Programmable Characters (Optional), On-Board Z80-CPU, 2K BYTES Independent On-Board Ram Memory, Glitch-free Display.	\$520
1 Board for Single or Multi-User System.	 <p>SBC-200 Single Board Computer</p>	Computailor Monitor 2K PROM (2716) Z80-CPU, 1K RAM, 16K EPROM, Serial I/O, Parallel I/O, Z80- CTC, 4MHz Operation, Optional Vectored Interrupts, Power-on jump to 4K boundaries, On-board memory can be switched out under programme control. Free: Computailor Monitor PROM (2716).	\$495

FULL SYSTEMS:

Any configuration from a simple dedicated system or a single user system to the most complex multi user system. Arranged with a selection of floppy disk drives, hard disk drives, printers and VDUs.

PERIPHERALS:

VDUs, printers, disk drives, etc.

SOFTWARE:

Single user CP/M 2.2 operating system \$160

Multi user MP/M 2.0 operating system \$460

Enquire for customized operating systems. Pascal, BASIC, FORTRAN, Word processor (Wordstar) and Utility programs are also available on request.

Ask for our short form catalogue.

All prices are tax free; add 17 1/2% sales tax if applicable.
Mail orders are welcome, add \$3 — postage.

Prices and specs. subject to change without notice.



harmless if used properly), so that the machine, having displayed the result of the reaction test, will sit and do nothing until you press RESET.

Clock

This program uses the 'two-digit print' routine, too.

When it first starts up, it will put a time onto the screen, and then start updating it, giving a 12-hour display of

hours, minutes and seconds, updated once a second.

Unfortunately, it's not too accurate (a few seconds per hour), but it shows what can be done — and with a bit more ingenuity we can improve the accuracy.

The time that the clock starts at is determined by the initial values of V3, 4 and 5, as set in statements 0604 to 0608 of the program. V3 is hours, V4 minutes and V5 seconds.

Remember to set them to reasonable values, otherwise the program will not work (V3 has to be from 01 to 0C, V4 and V5 from 00 to 3B).

How it works

The first statement sets the length of the timing loop (that's like the little adjustment screw in your old analogue watch — no, your digital watch hasn't got one!)

Adjusting the value of V7 will vary the speed of the clock. I found a value of 33 hex to be about right.

Statement 0602 sets the value of the timer to that of V7, so that from this point, the timer is ticking down towards zero at a rate of 50 per second.

The next three statements set the initial values of the hours, minutes and seconds digits.

Statements 060A and 060C set the values of VB and VC, which control the position of the display on the screen. The values I've put in give a display that's about central.

The 00E0 instruction sends the program momentarily to a little machine code routine somewhere deep inside the monitor that clears the screen.

If you have a look at the 'two-digit print' routine, you'll notice that VD is used to carry the number that is to be put onto the screen.

So statement 0610 sets VD to the first part of the display — the hours digit.

0612 sends the program to the print routine, and this puts the value of VD on the screen at a position set by VB and VC, and also updates the value of VB to move it to the right.

0614 sets the memory pointer to the screen image of a colon ':', which you have entered at 06D5 (the byte at 06D4 is not important, by the way).

Statement 0616 puts the colon onto the screen. Then 0618 increases the value of VB, which makes sure that the next part of the display is in the right place.

By this time, you should be able to follow the rest of the program up to 0626 by yourself — all that's happening is that the minutes display is put on the screen, followed by another colon, and then the seconds display.

Now comes the timing loop. 0628 sets V6 to the value of the timer, and 062A checks to see whether it has reached zero yet (which it will do about a second after being set at statement 0602).

If the timer has not yet reached zero, statement 062A has no effect, and statement 062C will send the program back round the loop to check on the timer again.

When it does reach zero, statement 062A will send the program to 062E, where the timer will immediately be set to V7 again, ready for the next timing period.

While the timer is counting down to zero again (and this happens fairly slowly in terms of the rest of the program), the machine can be doing a lot of other things.

So the timer is set in 062E, and the program changes the values in V3, 4 and 5 and redisplay them, getting back to the timing loop at statements 0628 to 062C in plenty of time to catch it before the timer reaches zero again.

Statement 0630 is the seconds digit being updated. If it is less than 60 decimal, nothing else needs to be done, and so statement 0632 has no effect and 0634 sends the program back up to 060A (notice that it is necessary to re-initialise the value in VB to have the display in the same place next time).

If, however, the seconds display *has* reached 60 decimal, then statement 0632 sends the program to 0636, which sets the seconds to zero.

The next statement increases the minutes digit (V4) by one, and the following statements check to see if it has reached 60. If it has not, we go back to 060A — if it *has*, then the minutes are also set to zero and the *hours* are increased by one.

Statement 0642 is worth looking at. This and the following statements check to see whether the hours have reached 13 decimal. If it has, it sets it to 1 decimal. So the display will go from 12 o'clock to 1 o'clock. Notice that this little section of the program is slightly different from the parts that update the seconds — that's because logically we should count from 0 o'clock to 11 o'clock and then back to 0 o'clock!

By the way, if you want to make it a 24-hour clock, you'll have to alter the following statements:

0642 SKIP IF V3=17 3318

and

0646 V3=00 6300

Now can you see why some people (especially computer programmers) prefer a 24-hour clock? ●

CLOCK

```

0600 V7=33          6732
2  TIME=V7          F715
4  V3=00             6300
6  V4=00             6400
8  V5=00             6500
A  VB=0D             6B0D
C  VC=14             6C14
E  CLR SCREEN       00E0
0610 VD=V3           8D30
2  DO 0704           2704
4  I=06D5            A6D5
6  SHOW 5 @ VB, VC  DBC5
8  VB=VB+05          7B05
A  VD=V4             8D40
C  DO 0704           2704
E  I=06D5            A6D5
0620 SHOW 5 @ VB, VC  DBC5
2  VB=VB+05          7B05
4  VD=V5             8D50
6  DO 0704           2704
8  V6=TIME           F607
A  SKIP IF V6=00     3600
C  GOTO 0628         1628
E  TIME=V7          F715
0630 V5=V5+01        7501
2  SKIP IF V5=3C     353C
4  GOTO 060A         160A
6  V5=00             6500
8  V4=V4+01          7401
A  SKIP IF V4=3C     343C
C  GOTO 060A         160A
E  V4=00             6400
0640 V3=V3+01        7301
2  SKIP IF V3=0D     330D
4  GOTO 060A         160A
6  V3=01             6301
8  GOTO 060A         160A

THE FOLLOWING SHOULD ALSO BE
LOADED (THIS IS THE DATA FOR
THE ':').

06D4 0000
6 4000
8 4000

```

A program to put an hours:minutes:seconds 12-hour clock display onto the screen (accurate to a few seconds per hour, unfortunately).

This program makes use of the 'two-digit print' routine, which should be loaded into locations 0704-0716.

PERFORMANCE: DECISION 1



Microtrix proudly presents the entire range of MORROW DESIGNS IEEE 696 S100 products. They represent an integrated set of high performance, state-of-the-art boards and systems.

Decision 1

The Decision 1 is an attractive, versatile, IEEE 696 S100 computer utilising the advanced boards from MORROW DESIGNS. Whether you're building a single or multi-user system, the Decision 1 offers you a hardware/software combination unmatched in the field. Decision 1 is not simply an improved 8-bit microcomputer: it's a breakthrough. In both computing power and price.

Central Processing Unit

The CPU card, designed to function like an IBM 370* processor, features dynamic allocation of memory in 4K increments to 1 Megabyte; supervisor control of users; sophisticated trapping mechanism; and optional floating point processor.

DMA Floppy Controller

This controller is sheer brilliance! It implements full DMA as per IEEE 696 specifications, utilising an on-board Z-80A to supervise operations. Using MORROW's channel drive concept, operation is

not unlike the channel controllers which attach to IBM 370* mainframes, enhancing system throughput. Memory and I/O mapped controllers are also available.

DMA Hard Disk Controller

Second to none in the world for speed, size, and cost, this controller also employs the channel drive concept and DMA transfers. The fast Signetics 8X300 microsequencer is used to control all drive functions.

Micronix Operating System

A multi-user, multi-tasking operating system designed to operate on the Decision 1 with hard disks. Functionally equivalent to Bell Lab's UNIX, it also provides a CP/M emulator allowing use of all CP/M programs. Up to 15 users can be supported.

And More

Other products include a 64K static memory board with bank select and extended addressing; I/O cards; floppy disc systems; and 5, 10, 20, or 26 Megabyte hard disk systems.

Information?

Please write or phone for further information and pricing on these advanced products.

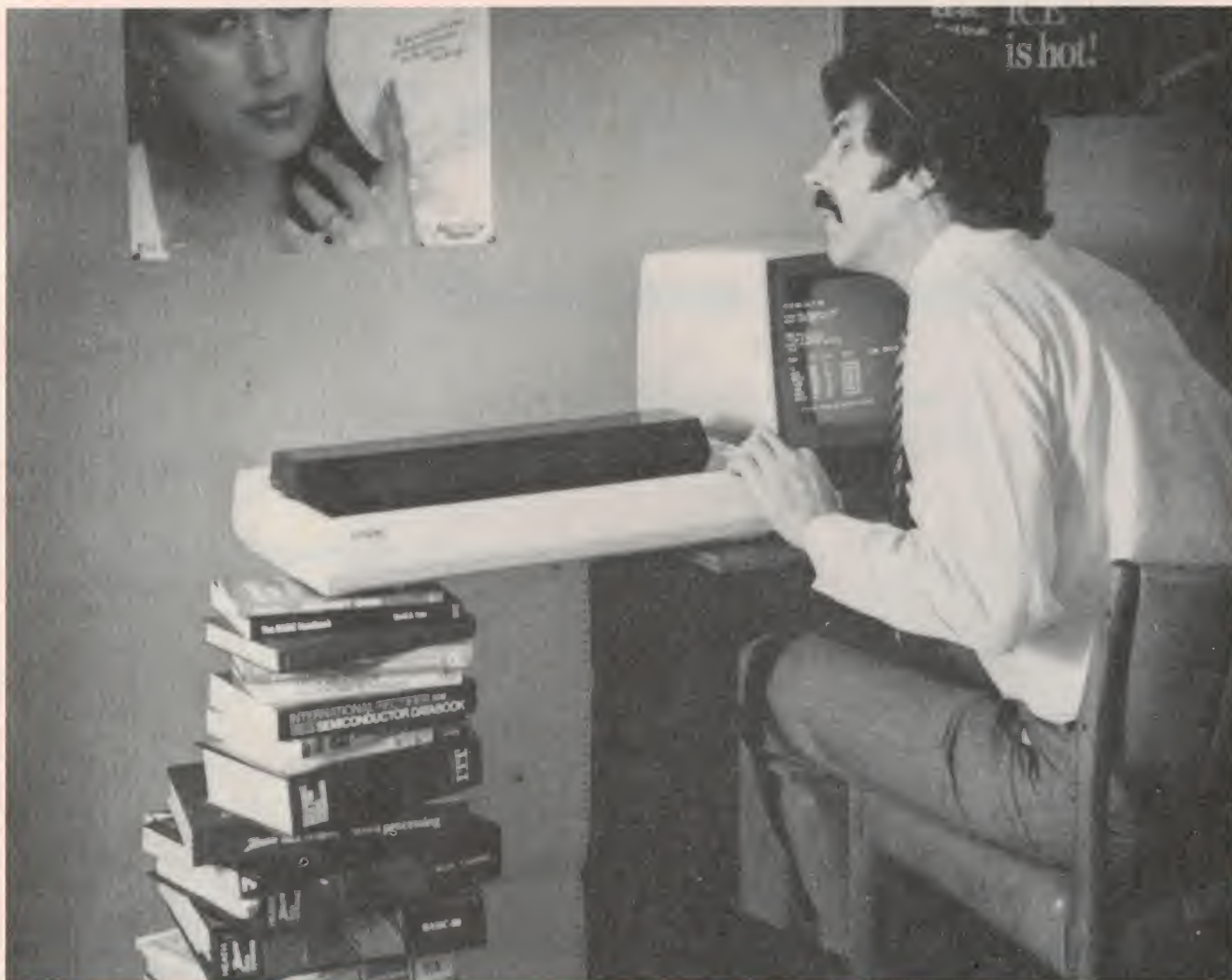
Product specifications are subject to change without notice

*IBM 370 is a trademark of IBM corp.

Decision 1 and Micronix are trademarks of Morrow Designs



75 Grand Boulevard, Montmorency, 3094 Vic.
Phone (03) 439 5257
Postal: PO Box 158 Hurstbridge, Vic. 3099.



The MX-100. Not just better. Bigger Epson

Our MX-80 was a pretty tough act to follow. I mean, how do you top the best-selling printer in the world? Frankly, it wasn't easy. But the results of many sleepless nights will knock your socks off. The MX-100 is a printer that must be seen to be believed. For starters, it features unmatched correspondence quality printing, and an ultra-high resolution bit image graphics capability. Then the ability to print up to 233 columns of information on 15" wide paper to give you the most incredible spread sheets you're ever likely to see. Finally, to top it all off, a satin-smooth friction feed platen and fully adjustable, removable tractors. And the list of standard features goes on and on.

Needless to say, the specs on this machine are practically unbelievable. But there's something about the MX-100 that goes far beyond just the specs; something about the way

it all comes together, the attention to detail, the fit, the feel. Mere words fail us. But when you see an MX-100, you'll know what we mean.

All in all, the Epson MX-100 is the most remarkable printer we've ever seen in Australia to date. How can you not afford to consider the new MX-100, even if you have to buy a bigger desk!



Dealer Enquiries Welcome

EPSON

For further information contact your local **WARBURTON FRANKI** office.



WARBURTON FRANKI

• ADELAIDE (08) 356-7333 • BRISBANE (07) 52-7255 • HOBART (002) 28-0321
• MELBOURNE (03) 699-4999 • PERTH (09) 277-7000 • SYDNEY (02) 648-1711
• AUCKLAND N.Z. (09) 50-4458 • WELLINGTON N.Z. (04) 69-3016

Programming the '660 in colour

(... painting by numbers!)

For constructors of the ETI-660 (or about-to-be constructors), here's how to get it to put colour on your TV screen!

Phil Cohen

NO DOUBT, having got your '660 going, you've been hankering to try it out in lurid colour! Sorry to keep you waiting, but you'll find it has been worthwhile. First of all, though, you're going to have to do a minor modification, as detailed in the accompanying panel. The modification permits colouring all the available blocks on screen, not every other one — something we didn't know originally, despite the fact we had a demo program tape. Well, nobody's perfect! OK — on with it!

How it Works

Referring to your circuit (Nov. '81), IC16 is the colour RAM — it stores information about the colour of the various parts of the screen. Each location in IC16 contains three bits. These three bits give one of eight colours for the screen area. A screen area is eight 'pixels' wide and two high, a pixel being the smallest part of the screen that you can turn on. The display on the screen contains 3072 pixels in total; if you turn the whole screen display on, all 3072 pixels are used.

The screen colour, then, can be set in a matrix eight wide by 24 high — this is the number of 'areas' on the screen.

When the 1864 (IC4) asks the processor to send it the screen RAM information, the processor will step through



the screen memory one byte at a time, and the information will go via the data buss into the 1864. As this is happening, the address information is also being fed to IC16, and it will respond by putting its three bits of colour information out at pins 12, 14 and 16.

These will reach the colour input pins of the 1864, and cause it to set the colour

of the various parts of the screen.

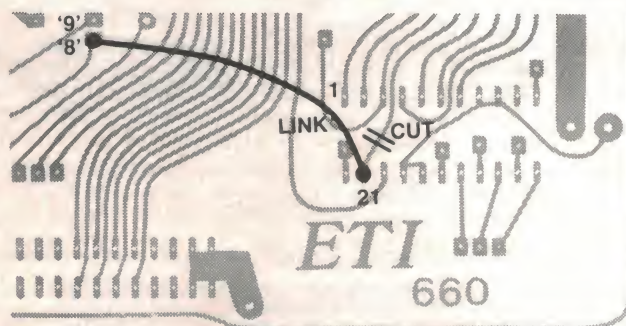
The software given here will allow you to write your own colour programs in CHIP-8, without having to worry about quite how the machine code part of the system works. However, when you graduate to writing programs in machine code, you will need to know how the colour is set.

A SMALL MODIFICATION

Take your naked '660 pc board (i.e. with the case stripped off). Modestly position the board so that the keyboard faces away from you. Now turn the board over. On your right, at the bottom edge of the board, you should spy 'ETI 660'. Now you're ready to do the deed. Just above the ETI 660 marking you'll find the pins for IC16. Identify pin 21. A track runs from pin 21, between pins 3 and 4, to a feedthrough link pad between IC16 and IC10. Cut the track as indicated on the diagram here. Remove the copper for about 2 mm; a Stanley knife is good for this job. Don't use a drill to cut the track — you may cause damage on the top side of the board.

Now cut a length of insulated hookup wire about 45 mm long, and bare and tin both ends. Using this, join pin 21 of IC16 and the pad shown in the diagram here.

To check that you've done it properly, identify the corresponding pad on the top side of the board. It should be marked '8'. Now you can put the '660 back together and get on with your colour programming.



This is how it's done: the byte that holds the colour information in its lower three bits is written into the screen memory at the position required. As the 1802 is a static processor, the address and data information will remain there after this has been done. Immediately after this memory transfer, execute an 'OUT 3' instruction. This will cause the 1864 to pulse the R/W pin of IC16, clocking the information in.

In fact, the above procedure will write into the screen RAM as well — there's no need to do that too.

The screen RAM will notice if bit 9 of the address is set, and if it is, will not respond. However, IC16 is not connected to bit 9, and so the routine becomes as follows:

- Decide on the colour and set the lower three bits of a byte accordingly.
- Decide on the screen position and translate that into an address. Now set bit 9 of the address.
- Put the colour bit into memory at the address (an STR instruction will do this).
- Execute an OUT 3.
Happy colouring!

Colour routines

I've put all the colour software up into the 'top' of memory — that is, I've arranged it so that it finishes just on location 07FF, which is the last one. This leaves the maximum amount of room for the main program.

The first routine, which is entered by inserting an 07C1 into the CHIP-8 program, turns on the colour facility.

This routine is fairly self-explanatory for those who understand machine code — and for the rest, well, you'll just have to wait until we explain the 1802 machine statements! Alternatively, you could get hold of 'Programmer's Guide to the 1802' by Tom Swan (see p.96, March '82).

The next routine alters the background colour; it's called by an 07A2 in the CHIP-8 program. When you first turn the machine on, the background colour will be blue. If you then call the routine at location 07A2, the background will change to black. The next call of the routine will set it to green, and the next to red. A further call will set it to blue again.

So, by the number of calls that you have at the start of your main program, you can choose the background colour you want. NOTE: In order to use this routine, you do not have to run the one that enables the colour.

The last routine is a CHIP-8 one, which in turn calls a machine code

COLOUR ROUTINES

There are three routines here, all jammed together at the top of memory to allow the maximum amount of room for the rest of the program. The first is a machine code routine which **enables the colour** facility, and it is called from the main program by an 07C1 CHIP-8 instruction — i.e. 'run a machine code routine at location 07C1'. The next routine **alters the colour of the background** in the sequence 'blue, black, green, red, blue ...'. Each time the routine is called, the background colour will advance one — it starts with blue, and so after the first call of the routine the colour will be black, and so on. This routine is called from CHIP-8 by an '07A2' instruction. The third routine allows you to **alter the colour of a two-byte area** of the screen. Set VE to the horizontal co-ordinate (from 0 to 7), VF to the vertical co-ordinate (from 0 to 17 hex), and VD to the colour, according to this table:

0	black
1	red
2	blue
3	violet
4	green
5	yellow
6	pale blue
7	white

The routine is called from CHIP-8 by a '27AB' instruction — that is, 'call the CHIP-8 subroutine at location 07AB'. Locations 07A5 to 07AA are reserved for use by these routines. Before you use any of these routines, make sure that you modify the hardware as described in the article.

```
07A2  SEX 9      E9
      3  OUT 1    61
      4  RETURN   D4
```

07A5 TO 07AA RESERVED

```
07AB  I=07A5    A7A5
      D  M(I)=V0:V2 F255
      F  V0=VD    80D0
```

```
07B1  V1=VE      81E0
      3  V2=VF      82F0
      5  I=07A8    A7A8
      7  M(I)=V0:V2 F255
      9  I=07A5    A7A5
      B  V0:V2=M(I) F265
      D  CALL 07D1 07D1
      F  RETURN    00EE
```

```
07C1  LDI 39      F839
      3  PLO F      AF
      4  GHI 6      96
      5  PHI F      BF
      6  SEX F      EF
      7  LDI 2C     F82C
      9  STR F      5F
      A  OUT 2      62
      B  DEC F      2F
      C  LDI 20     F820
      E  STR F      5F
      F  OUT 2      62
07D0  RETURN      D4
```

```
      1  LDI 07      F807
      3  PHI E      BE
      4  LDI A8      F8A8
      6  PLO E      AE
      7  SEX E      EE
      8  LDXA       72
      9  ANI 07      FA07
      B  PHI F      BF
      C  LDX        FO
      D  ANI 07      FA07
      F  STR E      5E
07E0  INC E        1E
      1  LDX        FO
      2  ANI 1F      FA1F
      4  SHL        FE
      5  SHL        FE
      6  SHL        FE
      7  SHL        FE
      8  STR E      5E
      9  LDI 0C      F80C
      B  ADCI 00     7C00
      D  PHI D      BD
      E  LDI 80      F880
07F0  ADD          F4
      1  PLO F      AF
      2  GHI D      9D
      3  ADCI 00     7C00
      5  PHI D      BD
      6  GLO F      8F
      7  DEC E      2E
      8  ADD          F4
      9  PLO D      AD
      A  SEX D      ED
      B  GHI F      9F
      C  STR D      5D
      D  OUT 3      63
      E  SEX 2      E2
      F  RETURN      D4
```

Computer
retailers...
If you're not
selling our
software
you're
probably
losing sales.



Give your clients the best reason for buying your computer:- The best software to run on it. We are Australia's leading distributor of WordStar. WordStar is the most powerful and versatile fully integrated word processor package you can buy for a microcomputer.

This means it's just about the best way of selling your computer hardware.

WordStar is designed for people. Non technical people. The sort of people that we both know should be using and benefitting from computers now.

WordStar will help you convince them.

How?

Firstly by its ease of use and ease of training.

WordStar programs make your client's staff productive in the shortest possible time.

With the new WordStar Training Guide, a typist gets a basic grounding in just four hours.

Enough to be able to write most letters and reports. In two days she will be able to use WordStar, MailMerge and SpellStar. The WordStar package is so simple to learn there's no need for training courses or trained personnel.

Help menus and variable levels of 'on screen' help make the learning process quicker. So there is less need to continually refer to a manual.

At the highest level, the learning operator is given full instructions. With greater familiarity, help can be decreased and the full screen used for text.

WordStar is obvious and graphic. Margins, justified and ragged text are shown on screen just as they will be in print. Word-wrap removes the need for carriage return. The installation program generates

WordStar for use on nearly all popular terminals and printers. So equipment changes won't cause delay or additional software expense.

The MailMerge option lets you generate personalized letters, forms

and contracts, as well as customer lists and mailing labels. Like all the WordStar options, it's

totally integrated with WordStar so it can be used with all existing WordStar files. Additional data can be inserted at any time.

SpellStar, WordStar's proofreading option means never having to re-read a whole document to check for spelling errors or 'typos'. And because it's totally integrated, you just enter 'S' from WordStar's 'no file menu' and SpellStar checks your letter against its 20,000 word dictionary and flags any words it can't find. New words can be ignored or added to the dictionary. And because you're in WordStar, you can edit at the same time as you fix mistakes.

The integrated packages don't stop there. If your client needs to make planning decisions and forecasts, he can do it with another arm of MicroPro.

CalcStar. This new Electronic Spreadsheet and financial modelling program lets your client make budget plans and get answers to all those 'what if' questions. Of course CalcStar joins with WordStar, to

produce spread-sheet and text output.

The video screen becomes a 'window' on a giant ledger sheet.

If your client is getting bogged down with filing cabinets, folders and paper forms, yet

another WordStar option will come to his rescue.

DataStar is the microworld's most comprehensive data entry, updating and retrieval system. It will create forms, and quickly and accurately enter data on the screen. It allows data to be combined and rearranged.

What do we have to offer that's so special?

Basically, we know more about MicroPro software, especially the WordStar system than anybody else in Australia. We know it's the best. And we want you to sell it. So we're ready to back you in a number of very important (we believe essential) ways.

We have a wide range of machines on our premises. Including Superbrain, Apple II, Vector Graphics, NorthStar, Dynabyte and OPAL. So we know exactly how to install MicroPro software in most machines and formats. It also means that we can offer software and data file transfer of your own or your client's files. This is the kind of security and service your client needs. The kind of service you will be able to offer him as one of our accredited dealers.

We produce MicroPro software and manuals right here in Australia under license from MicroPro. So if a registered client's disc gets damaged and he hasn't got a backup, changeover is no problem.

So whether your business is big or small, if you're selling microcomputers and you're not selling our software, we want to hear from you right away.

MicroPro International

Prices are suggested retail only

Wordstar	\$495.00
Wordstar Training Guide	\$50.00
Apple Wordstar	\$395.00
MailMerge (file management option)	\$150.00
SpellStar (dictionary option)	\$250.00
CalcStar (electronic spreadsheet)	\$295.00
SuperSort (sort package)	\$250.00
WordMaster (text editor)	\$150.00
DataStar (data entry package)	\$350.00
Wordstar Customization Notes	\$500.00

JOHN F. ROSE

COMPUTER SERVICES PTY LTD

33-35 Atchison Street, St Leonards NSW 2065
Phone (02) 439 1220
Telex AA27901



routine. In order to use this routine, first set VE to the position *across* the screen whose colour you want to set (left hand side of the screen = 0, right hand side = 7).

Then set VF to the position *down* the screen (top of the screen = 0, bottom = 17 hex).

Now set VD to the colour you want (according to the table given next to the program) and you're set.

Then all you have to do is put in a 27AB instruction, which will send the program to the CHIP-8 subroutine at 07AB. The first thing this does is to save in memory the contents of V0 through V2 (these variables are used by the routine). Then it puts the values of VD, VE and VF into memory in the area 07A8 to 07AA. Finally it restores the old values of V0 through V2 (so that these are not altered by the routine). It then calls the machine code routine at 07D1 and returns to the main program.

Again, I won't go into the complexities of the machine code routine at this stage — but those of you who have access to a book or two on the subject (like Tom Swan's, mentioned earlier) may like to work your way through it.

Those of you who don't know about machine code — well, just enter it in the same way as a CHIP-8 program (the only difference is that a line of machine code program sometimes has one byte in it and sometimes two — but if you start at the correct address and just keep

going, you should be right).

Colour test program

So that you can test out your routines properly, I've included a short program that 'exercises' all the software in the colour routines.

The first thing it does (statement 0600) is to call the routine that turns on the colour. Then (statements 0602 to 8) it sets location 0700 to FF (I could just have told you to do this, but it is a useful example of how to do it from inside a program). The next part of the program writes the contents of location 0700 (which is why we set it) to every location on the screen. It does this by means of two loops — one inside the other (this is called a pair of 'nested loops'). At the middle of the loops (which cause V0 to go from 0 to 7 and V1 to go from 0 to 36) is statement 060E, which actually puts the FF onto the screen. So by the time we reach 061E, the screen should all be on.

This is necessary for what we are about to do because if the screen is off, it will show the background colour (which at present is blue), so in order to see what effect we're having on the screen colour, we have to turn it *all* on. Normally, only the area of screen that was going to be used to display something would be set to a particular colour — but this way, we can see the colour of all of the parts of the screen.

Anyway, we've reached 061E, and the next thing that we do is to get from the keyboard the co-ordinates of the area whose colour we want to change, and then the colour that we want to set it to. Statement 0624 then sends the machine to the colour-changing routine. The next statement (0626) changes the background colour as well, just for good measure. Type in the colour routines, and then the test program. Then record what you have in memory onto tape.

Now set the program going. The screen background colour should be blue, and the middle part of the screen should start to go black from the top downwards. In fact, not all of it will be black — as the colour RAM has not been altered since you turned the machine on, the colour at the various points of the screen will be random. But most of it should be black.

Now press the following key sequence: 0, 0, 1.

Two things should happen simultaneously when you press the third key — the surrounds of the screen should go black, and the block in the top left hand corner should go red (if it wasn't red already).

Now do: 0, 1, 1. The screen colour should change again, and the next block down should go red.

If the two red blocks are not next to each other (i.e. touching), then re-check the hardware modification described in this article.

COLOUR TEST PROGRAM

This little program will allow you to test the colour routines that you have just loaded. First load the colour routines (locations 07A2 to 07FF), then record them, then play them back into the machine, then load and run this program.

The program will first call the colour-enabling routine, then fill the screen, then wait for input.

Put in three digits, the first being the horizontal co-ordinate, the second the vertical co-ordinate and the third the colour. You should see the area that you specified change colour, and the background will change colour too. The program will then wait for the next three digits.

NOTES: The screen will come up first of all with a random colour setting — this is normal. Because you can only enter a single digit for the vertical co-ordinate, you will only be able to access the top two thirds of the screen.

0600	CALL 07C1	07C1
2	V0=FF	60FF
4	V1=00	6100
6	I=0700	A700
8	M(I)=V0:V0	F055
A	V0=00	6000
C	I=0700	A700
E	SHOW 1 AT V0, V1	D011
0610	V0=V0+08	7008
2	SKIP IF V0=40	3040
4	GOTO 060E	160E
6	V0=00	6000
8	V1=V1+01	7101
A	SKIP IF V1=37	3137
C	GOTO 060E	160E
E	VE=KEY	FEOA
0620	VF=KEY	FFOA
2	VD=KEY	FIOA
4	OC 07AB	27AB
6	CALL 07A2	07A2
8	GOTO 061E	161E

REACTION TIMER — COLOUR PATCHES

These two patches will convert the reaction timer to colour operation (you will need to load the reaction timer program, the two-digit print routine and the colour software, and then include the following changes and additions).

These will cause the 'I' to appear red on a black background, and then the reaction time result to appear either red (if it's over 220 milliseconds) or green (if it's under). You may need to turn the brightness of your set up a bit for best results.

0600	CHANGE	A6D0	TO	
		GOTO 0650		1650
0628	CHANGE	6A64	TO	
		GOTO 0670		1670
0650	CALL	07C1		07C1
2	CALL	07A2		07A2
4	VE=00			6E00
6	VF=0A			6FOA
8	VD=01			6D01
A	DO 07AB			27AB
C	VF=0B			6FOB
E	DO 07AB			27AB
0660	VF=0C			6FOC
2	DO 07AB			27AB
4	I=06D0			A6D0
6	GOTO 0602			1602

0670	VE=V3	8E30
2	V1=VD	81D0
4	VD=04	6D04
6	VA=18	6A18
8	VE=VE-VA	8EA5
A	SKIP IF VF=00	3F00
C	VD=01	6D01
E	VE=02	6E02
0680	VF=0A	6FOA
2	DO 07AB	27AB
4	VE=VE+01	7E01
6	SKIP IF VE=05	3E05
8	GOTO 0682	1682
A	VE=02	6E02
C	VF=VF+01	7F01
E	SKIP IF VF=0D	3F0D
0690	GOTO 0682	1682
2	VA=64	6A64
4	VD=V1	8D10
6	GOTO 062A	162A

ETI-660 — FURTHER EXPANSION

We are presently working on a number of expansion projects for the ETI-660 Learners' Micro-computer. In progress is a BASIC interpreter so that you can program the '660 in the most popular microcomputer language. We plan to make this available in ROM. Naturally, this will require a full-size QWERTY keyboard (ASCII-encoded) and we will be coming up with interfacing details. Then, you'll require more memory — a memory expansion board is 'in the pipeline'. Meanwhile, we have some more exciting programs coming. Stay tuned!

Reaction Timer — colour

The reaction timer program published in this issue can be altered to make use of the colour facility.

This is done by a method known as 'patching'. This is the software equivalent of building a circuit using string and glue. It's not recommended for doing alterations to your own programs — and I've only used it here for simplicity.

What happens is that at a particular part of the program you insert a GOTO statement which sends the program to another part of memory. In this part of the memory is a routine that you wanted to insert into the program. You do the routine, and then GOTO back to the statement after the one you jumped from.

All this is done in an effort to avoid having to remember the whole program (or in this case, to avoid the tedium of having to re-enter the whole thing).

The first patch (which goes into the main program at 0600) turns on the colour (statement 0650), and then changes the background colour (0652) to black.

The next few lines change the colour of the part of the screen which will hold the '!' to red.

Notice that the screen will stay black at this area until we actually write

something there.

The patch then does what the original statement 0600 did (statement 0664) and then jumps back to the statement after the altered one.

The next patch is more complex. What it does is to set the area which will hold the results to either green or red, depending on the results — so if your reaction time is OK, you get a green display, but if it's not, you get red.

The first statement copies the value of V3. This holds, at the point of the program we're coming from, the number of hundredths of a second of the reaction time. The next statement copies the value of VD. Since the colour routine uses VD, we have to store it at the start of this patch and then reset it at the end (statement 0694).

Statement 0674 sets VD (which is the colour variable) to 04 — green. VA is set to 18 hex, which is 24 in decimal.

The next couple of statements check to see whether the time is less than 24 hundredths of a second. Statement 0678 subtracts 24 decimal from the number in VE. If the answer is zero or less, VF will be set to 01, otherwise it will be set to 00.

So by looking at the value in VF at statement 067A, we can tell whether the result of the subtraction at state-

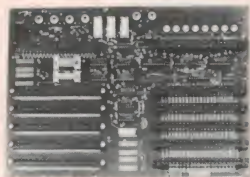
ment 0678 was above or below zero — and if you think about it, this will tell us whether the value in VE was above or below 18 hex.

If the value in VE was *below* 18 hex, this means that the reaction time is OK — VF will be set to 00 at statement 0678, and statement 067A will cause the machine to skip statement 067C. If this happens, VD will remain at 04 — green. If the value in VE was *higher* than 18 hex, however, statement 067A will have no effect, and statement 067C will set VD to 01 — red. So by the time we reach 067E, VD will be either red or green, depending on the reaction time.

The next few statements (067E to 0690) simply use this value of VD to set the area of the screen which will show the reaction time display. Two loops are used, with VE (the horizontal value) going from 02 to 04, and VF (the vertical value) going from 0A to 0C. It will be instructive for you to follow these statements through for yourself.

The next two statements — 0692 and 0694 — set VA and VD to the values that they will need back in the main program. Notice that we have to set VA because the statement that we replaced (0628) to put in the patch did this originally. Finally, we jump back into the main program at 062A.

AIM 65 SYM-1 MOTHERBOARD



FEATURES

- * Room for five expansion boards
- * Works with AIM, SYM and KIM
- * Fully buffered address, data and control lines
- * Switches select expansion board addresses
- * Convenient terminal strip power connections
- * Phono jacks for TTV and cassette connections
- * Cassette control relays
- * Cassette input monitor LED
- * Application connector solder eyelets
- * Standard KIM-4 bus expansion connections
- * Compact vertical orientation
- * Generates decode signal for KIM
- * Host ports A and B brought to DIP socket
- * Card cage to suit Mother plus

TCE 303 \$28

AIM65/40-48K \$1291. Stock

EPSON MX80 \$730

PL65 for AIM65 \$145

Microsoft Basic for AIM65 \$65

energy CONTROL

P.O. BOX 6502

GOODNA 4300

Phone

(07) 288-2757

BANKCARD available for Australian & N.Z. customers. Same P & P for N.Z. & Australia. Prices subject to change without notice. Plus sales tax if applicable.

Don't Miss

GREAT VALUE

Hitachi Level III
'peach'

32K RAM, 24K ROM

\$1495

EPSON MX 100

\$1130

plus sales tax if applicable
FROM . . .

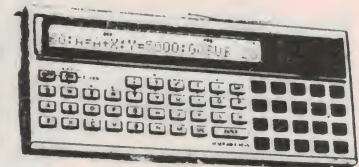
CW

COMPUTERWARE

305 La Trobe Street,
Melbourne, 3000

Telephone: (03) 602 1006

Easy to follow programs
for your Tandy or Sharp
pocket computer.



1. 50 Programs in Basic for the home, school and office. For the business man, pocket datebook and lots of other programs saving time computing ad costs, profits, price mark-ups, hourly wages, invoice totals, more. \$10.50.
2. 50 More Programs Basic for the home, school and office. 50 more tested, ready-to-run practical programs in basic, a companion to our popular 50 programs in basic. \$10.50.
3. Murder in the Mansion and other computer adventures in pocket basic for the TRS-80—2nd edition. This expanded second edition of our popular software book is loaded with new, exciting, tested, ready-to-run programs. \$10.50.
4. Pocket Computing made easy. Now there's a quick easy way to make the computer do what you want—and learn programming as you go. \$10.50.
5. 101 Pocket Computer Programming tips and tricks. An incredible compendium of hints, tips, secrets, shortcuts and easy to follow instructions. \$10.50.
6. Basic Programming Worksheets. 40-sheet pads—\$3.50.

Send for our free catalogue.
Powerchip Software, PO Box 32,
Sth Caulfield Vic. 3162
Phone 529 2884

Enclosed cheque/money order of \$.....
For book number.....QTY.....
Worksheets.....
Including \$1 p&p per book (Max. \$3).

Richard Allan

RA8

AS SUPPLIED TO THE B.B.C.

The RA8 has been designed to achieve the maximum performance possible from a speaker system of average price and therefore some sensitivity has been sacrificed in favour of a smooth response.

The RA8 Loudspeaker system has a linear frequency response, a feature associated with all the RA range of enclosures. In consequence it only delivers the correct amount of bass output energy demanded by the input signal. Initially, it may sound slightly lacking in bass output, therefore it is advisable to play some material with a genuine bass content in order to be convinced of its true ability to reproduce the lower bass frequencies. This is achieved without excess energy and overhang associated with many so called hi-fi systems.

Typical Performance Specification

Power handling capacity	50 watts peak programme. 30 watts r.m.s.
Sensitivity	10 watts pink noise for 90 dB at 1 metre.
Frequency Response	90 Hz to 20 kHz = 3 dB.
Distortion	T.H.D. < 1% 100 Hz — 20 kHz.
Size	395 × 266 × 247 mm.

\$479⁰⁰

PER PAIR

"For detail and clarity the RA8's score high marks and it is not difficult to appreciate why the BBC have chosen them!"

Geoff Giles, "Practical Hi-Fi"



The ACOUSTIC FOUNDRY HiFi

56 King William Road, Goodwood 5034
(08) 2710276.

(Trade enquiries also welcome).

sinclair ZX81

Available from the following leading stores —

QUEENSLAND:

MYER — ALL BRANCHES

SOFTWARE 80

Shop 11/200 Mogill Rd., Taringa, 4068 (07)371 6996

DATACOM

Shop 16, S.G.I.O. Arc. Bundaberg, 4670 (071) 71 4740

A.C.T.:

COMPUTERWORLD

Shop G71, The Bridge, Woden Plaza (062) 81 1368

TASMANIA:

J. WALSH & SONS PTY. LTD.

130 Macquarie St., Hobart, 7000 (002) 34 7511

BIRCHALLS

118—120 Brisbane St., Launceston, 2250 (003) 31 3011

VICTORIA:

MYER MELBOURNE, City Store Only

RADIO PARTS GROUP

562 Spencer St., West Melbourne, 3003 (03) 329 7888

ROD IRVING ELECTRONICS

425 High St., Northcote, 3070 (03) 489 8131

MINIT COMPUTER SERVICE

119 McCrae St., Bendigo, 3550 (054) 43 2589

B.B.J. COMPUTER SHOP PTY. LTD.

88 Albert Rd., Sth. Melbourne, 3205 (03) 699 5622

W.A.:

MICRO BASE

127 Fitzgerald St., Perth, 6000 (09) 329 9308

S.A.:

MYER ADELAIDE

ACUIS TRADING

185 Pirie St., Adelaide, 5000 (08) 223 1900

N.T.

ASCOM ELECTRONICS

66 Hartley St., Alice Springs, 5750 (089) 52 1713

N.S.W.:

B.B.J. COMPUTER SHOP PTY. LTD.

329 Pacific Hwy., Crows Nest, 2065 (02) 922 4022

CITY PERSONAL COMPUTER

75 Castlereagh St., Sydney, 2000 (02) 233 8992

DAVID REID ELECTRONICS PTY. LTD.

127 York St., Sydney, 2000 (02) 29 6601

COMPUTERWAVE PTY. LTD.

Lwr, Ground Floor, Myer, Sydney, 2000 (02) 238 9111

MINIT COMPUTER SERVICE

530 Kiewa St., Albury, 2640 (060) 21 5933

ORDER FORM: SINCLAIR EQUIPMENT (A'SIA) P/L

86-88 Nicholson St, Abbottsford, Vic. 3067. Ph. 419 3033.

QTY	ITEM	ITEM PRICE	TOTAL
	Ready assembled ZX81 Sinclair Personal Computer including mains adaptor, leads, BASIC manual	\$250	
	16K-BYTE RAM pack	\$150	
	8K-ROM (only required for ZX80)	\$ 75	
	ZX Printer (to be announced)		

I enclose cheque/Bankcard/Diners Club/Amex

Total _____

Name _____

Address _____

P'code _____

Signature _____

ETI

Sinclair

**finds the
missing link
(and goes
bananas for
ZX81)**



\$199

Including leads & Basic manual.

Mains adaptor \$17.50 extra.

SINCLAIR EQUIPMENT (A/SIA) P/L

86-88 Nicholson St., Abbotsford, Vic. 3067.

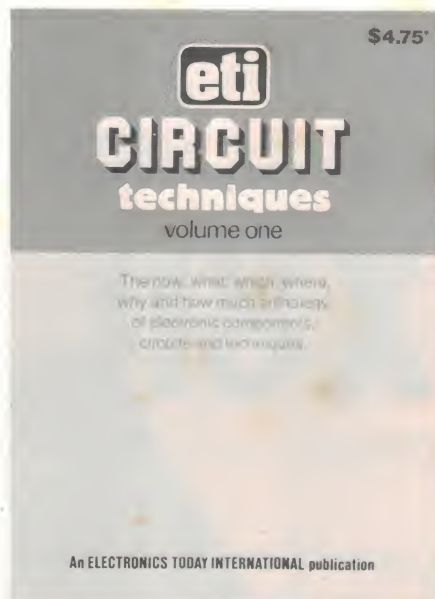
Tel. (03) 419 3033

★ Fill in guarantee card, send to Sinclair with receipt of purchase and we will send you a copy of Z Chess cassette free of charge.
This offer only applies to ZX81 purchased in Australia after 30/1/82. Valid for 1 month only.

STOP

Wasting time, effort, energy, solder.

This book will save you so much you'll wonder what you did before we published it!



CIRCUIT TECHNIQUES VOL. 1

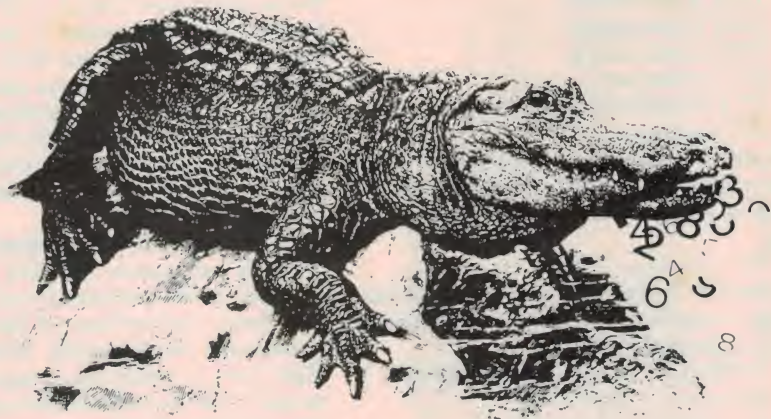
Only **\$4.75**

CIRCUIT TECHNIQUES Vol. 1. is a collection of 16 practical articles covering techniques and applications for some of the most widely used semiconductors in electronics — such as op-amps: from 741s and 3140s to 3080s; not to mention such lowly items as diodes, LEDs and zeners; then there's VFETs, MOSFETs and Schmitt triggers. And to round it out there are articles covering potcore inductor design, active filter design and crystal oscillator techniques.

Save yourself trouble. Don't dig through device application notes in search of a circuit to modify, start off on the right foot with Circuit Techniques Vol. 1. You'll probably get closer to where you want to be with fewer hassles. It's an invaluable reference for every electronics enthusiast, experimenter, technician or engineer.

Available from newsagents, selected electronic suppliers or direct from ETI Magazine, 15 Boundary St, Rushcutters Bay NSW 2011. Please add 65 cents for post and handling if buying by mail order.

RPN – the number crunching demon!



'Reverse Polish Notation' may sound like Pitjintjara if you're used to algebra, but it's the logical way to process masses of numerical information.

THIS IS THE FIRST of two articles describing how the most important part of a high-level language compiler works. In this first part the principles involved, the LIFO stack and Reverse Polish notation are explained and a BASIC program to convert arithmetic expressions into Reverse Polish is presented. Part Two examines how to compile this notation into 6502 assembly code — i.e. how to generate a compiler for the Apple or the PET, etc. This program could easily be modified for use with another processor, such as the 6800 or 6809. From these articles, readers without knowledge of assembly language will learn something about how high level language compilers work and those with more advanced knowledge will find the techniques described useful in writing their own compilers.

Why bother?

One of the most difficult tasks confronting the budding software expert is the translation of what appear to be simple arithmetic expressions into assembly language. After all, we have high-level languages such as BASIC that swallow $A + B * C$ and spit out the answer in one statement.

The reason is two-fold. First, the implementation of high-level languages is still poor on most micros. Second, there are still few such languages available on micros. Both these reasons should encourage an interest in the production of new compilers. It should also be pointed out (perhaps 'admitted' is better) that writing a compiler is one of the most difficult projects that can be

undertaken. So if you are bored with writing games of the 'ZAP the enemy' type, try a compiler — for an existing language or, even more of a challenge, for one of your own inventions.

The trouble with expressions like $A + B * C$ is that more than one operation, in this case two (one addition and one multiplication), have to be carried out before the result is obtained. In general computers can only do one thing at a time, so any complex expression would have to be split down as in the following example:

"Add A to B"
"Multiply the result by C"

Even this description is incomplete (in fact it is also wrong if applied to the expression $A + B * C$, but more of this later), for the computer has to put the result of adding A to B somewhere, i.e. in a temporary location, before multiplying by C.

These temporary locations have to be created automatically as required by the translation program and it is something of a problem to keep their number small. It is possible to avoid using temporary storage locations as such by the use of a 'stack'. This also brings other advantages in that the translation program is simpler.

A LIFO stack

A 'Last In, First Out' (LIFO) stack is very easy to understand. A good model is a shunting yard. If we consider a railway line as in Figure 1 with three wagons, A, B and C, then if we shunt A, B and C into the siding in that order

(Figure 2) then the first wagon out will be C, the last in. Next out will be B and then A.

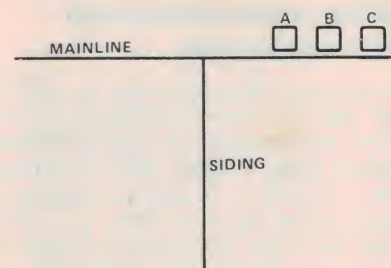


Figure 1. The shunting yard before the trucks are 'pushed' into the stack . . .

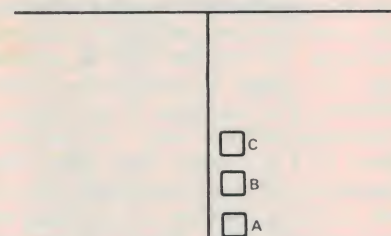


Figure 2. . . and the result after they have been 'pushed'.

In computer terms, a stack is an area of memory and two instructions, PUSH (usually abbreviated to PSH) and PULL (usually abbreviated to PUL), are used to place an item. To use our railway sidings model/analogy once again, if a wagon is outside the siding a PSH is required to put it inside; if a wagon is in the siding a PUL removes it.

Thus our shunting sequence would correspond to:

PSH A into siding
 PSH B into siding
 PSH C into siding
 PUL removes C
 PUL removes B
 PUL removes A

A stack can be implemented in BASIC as a string of characters, e.g: Z\$. Pushing an item or character on to the stack is:

Z\$ = 'character' + Z\$

where '+' in this case means concatenation — simply joining the two strings to form a longer string.

Pulling an item from the stack is:

'character' = LEFT\$(Z\$,1)

Z\$ = RIGHT\$(Z\$,LEN(Z\$)-1)

where LEFT\$(Z\$,n) gives the n left hand characters of the string, LEN(Z\$) gives the length of the string and RIGHT\$(Z\$,n) give the right n characters of the string.

At this point it might be helpful to write a program, namely to reverse the order of a string of letters. The answer is given at the end of the article but try it for yourself before looking at it in detail.

Order, precedence and Reverse Polish!

To return to the reason why $A + B * C$ is not 'add A to B then multiply by C', it is worth realising that you get a different answer from 'multiply B by C and then add A' which is in fact the correct interpretation, e.g: $2 + 3 * 4 = 2 + (3 * 4)$. That is to say, the *order* in which the calculation is carried out is important. How we define the order of evaluation of an arithmetic expression is to some extent arbitrary, but it is usual to carry out all multiplications and divisions first and then any additions and subtractions. To express this in another way, we assign a precedence to each operator. For example, if we assign a precedence of 1 to + and - and a precedence of 2 to * and / and agree that operators of higher precedence are carried out first, then we are adopting the conventional rule. The usual precedences are given in Table 1.

+	1	
-	1	
*	2	
/	2	
+	3	UNARY +
-	3	UNARY -

Table 1. Precedence values for arithmetic operations.

So we now know that $A + B * C$ means, by convention, B times C plus A. But how do we write A plus B all times C? The answer is of course to use brackets '()'. We can alter the order of operator by simply asking that any sub-expressions in brackets are evaluated *first*. Thus A plus B all times C would have to be written $(A + B) * C$.

Now we have a way of specifying the order of evaluation we meet the main problem in the computer evaluation of arithmetic expressions. If the order of evaluation were strictly from left to right then a computer program could simply read the expression and, apart from problems of temporary storage, could carry out each operation on the pair of variables to either side (as in our first example). However, as we have just discovered, the order of evaluation is not from left to right and if we ignore this fact we obtain the wrong answer.

Life would be a lot easier if we could find some way of writing arithmetic expressions so that the order of evaluation was always from left to right. This would mean that as we scanned the expression each operation could be carried out as soon as it was encountered and brackets would be unnecessary. Such a notation exists and is called 'Reverse Polish' — so called because of the unpronounceability by English speakers of the name of its inventor, Lukasiewicz, a Polish logician.

An expression in Reverse Polish (RP) is evaluated by scanning from left to right until an operator is met. When this happens the operator is applied to the two variables immediately to its left. The result is considered to be left in the expression, replacing all the variables and symbols involved. An example will make this clear.

Consider:

$AB * C +$

If we follow our rule, the first operator we encounter is '*' and the two variables to its left are A and B, so we form $A * B$ and put the result, T say, in place of $AB * C$ to give:

$TC +$

To continue, the next operator is '+' and we form $T + C$. So, to put the original expression into conventional notation we have:

$(A * B) + C$

As an exercise try evaluating:

$3, 4 * 6 + 3 /$

The answer is given at the end of the article.

We could insist that everyone learns RP, which is what some calculator manu-

facturers have done, or we could convert standard arithmetic expressions into RP. Using the concept of a stack this is easy.

The shunting yard algorithm

Obviously if we are going to read an RP expression from left to right but jump all over the place in an equivalent 'standard' expression then we are going to have to change the order of the operators when converting to RP. From the earlier example involving reversing a sequence of letters, it can be seen that a stack is useful in changing the order of a set of symbols. It is this ability which lies at the heart of the shunting yard algorithm. The algorithm uses a stack to change the order of the operator so that all high precedence operators and brackets are evaluated first. It works like this:

- If you encounter a variable name pass it to the output.
- If you encounter an operator stack it (i.e: push it on to the stack) unless there is an operator already on the stack with a higher precedence.
- If this is the case then the operator already on the stack should be carried out first so unstack it and pass it to the output.
- Repeat until you can stack the operator and then move on to the next item in the expression.

Brackets can be dealt with by starting a new stack when the opening bracket is encountered and by finishing evaluation when the closing bracket is encountered. Usually we do not start a new stack but simply place a marker on the old stack to indicate where the bracket was encountered (this might as well be the opening bracket itself). The full shunting yard algorithm can be seen in Figure 3.

Listing 1 shows a BASIC program that will convert any valid arithmetic expression into RP, with examples of its output given after it. The only complication with the BASIC program lies in the use of the unary + and - signs. The minus in $A - B$ has a different meaning from the one in $-A$, similarly the plus in $A + B$ does not mean the same as the one in $+A$. The program detects these unary symbols by checking if an operator or a variable was the last thing to be processed. If it was an operator or nothing then a + is converted into a ? and a - into a ! to show that they are unary. In calculations an RP expression or a binary operator is treated in the usual way except that it acts only on the *first*

variable to its left. The only other comments on the program are:

- W(I) is used to hold the precedence of the operators.
- Z\$ is the stack and Z(I) contains the precedence of the items on the stack.
- MID\$ A(\$,I,J) returns the J characters in the string starting at the Ith.

The parts of the program can be followed from the line numbers on Figure 3.

Summary

This article has introduced the reader to the LIFO stack and to Reverse Polish notation. A subroutine to convert an arithmetic expression to RP has been presented. Next time, again making use of the stack concept, we will show you how to compile an RP expression into 6502 assembly language (or into code for the 6800 or 6809 with certain modifications). Oh, the answer to $3,4*6+3/$ is 6.

```

10 INPUT A$
20 IF A$="" THEN GOTO 50
30 Z$=A$+Z$:REM**PUSH INPUT
   ONTO STACK
40 GOTO 10
50 IF Z$="" THEN STOP
60 A$=LEFT$(Z$,LEN(Z$)-1)
70 Z$=RIGHT$(Z$,LEN(Z$)-1)
80 PRINT A$
90 GOTO 50

```

● This is the program to demonstrate the action of a LIFO stack.

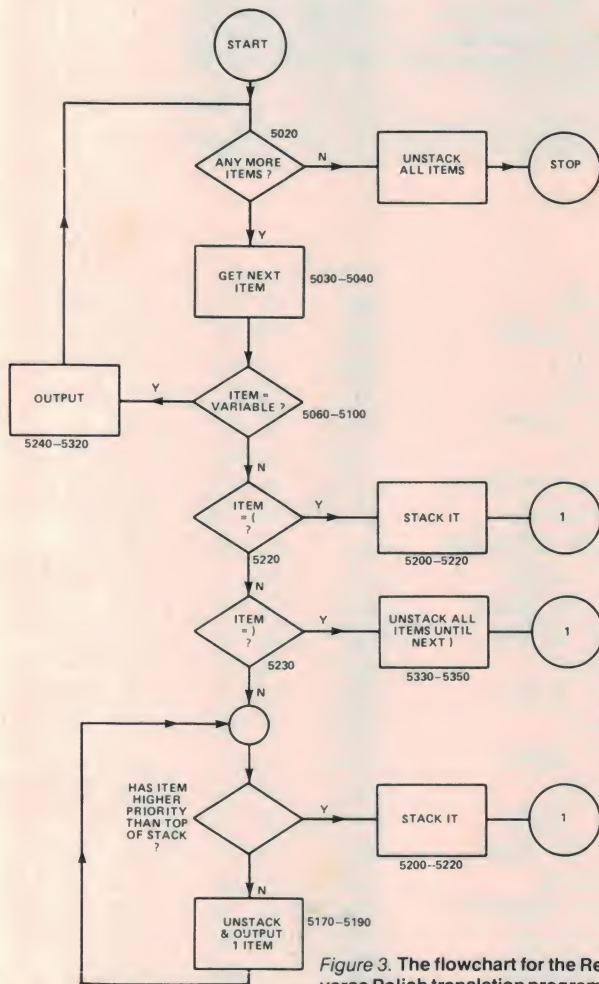


Figure 3. The flowchart for the Reverse Polish translation program.

Program Listing

```

10 DIM Z(25),W(5)
20 U$="-+*/()"
30 W(1)=1:W(2)=1:W(3)=2:W(4)=2:
   W(5)=0
40 INPUT A$
50 I=1
60 GOSUB 5000
70 PRINT A$,C$
80 GOTO 40
4999 REM**REVERSE POLISH ROUTINE
5000 Z$="":C$="":X=1:O=1
5010 FOR J=1 TO 25:Z(J)=0:NEXT J
5020 IF LEN(A$)<I THEN 5420

```

```

5030 B$=MID$(A$,I,1)
5040 IF B$="[SPC]" THEN I=I+1:GOTO 5020
5050 K=0
5060 FOR J=1 TO 6
5070 IF B$=MID$(U$,J,1) THEN K=J
5080 NEXT J
5090 IF K=6 THEN 5330
5100 IF K=0 THEN 5230
5110 S=W(K)
5120 IF S=0 THEN 5200
5130 IF S=1 THEN 5380
5140 O=1
5150 IF X=1 THEN 5200
5160 IF Z(X-1)<S THEN 5200
5170 C$=C$+LEFT$(Z$,1)
5180 X=X-1:Z$=RIGHT$(Z$,LEN(Z$)-1)
5190 GOTO 5150
5200 Z(X)=S
5210 Z$=B$+Z$:X=X+1:I=I+1
5220 GOTO 5020
5230 O=0
5240 IF B$<"A" THEN 5280
5250 IF B$>"Z" THEN 5280
5260 C$=C$+B$
5270 I=I+1
5280 IF B$>"9" THEN 5020
5290 IF B$<"0" THEN 5020
5300 C$=C$+B$
5310 I=I+1
5320 GOTO 5020
5330 IF LEN(Z$)=0 THEN I=I+1:GOTO 5020
5340 B$=LEFT$(Z$,1):Z$=RIGHT$(Z$,LEN(Z$)-1):
   X=X-1
5350 IF B$="(" THEN I=I+1:GOTO 5020
5360 C$=C$+B$:GOTO 5330
5370 IF O=0 THEN 5140
5380 S=6
5390 IF B$="-" THEN B$="!"
5400 IF B$="+" THEN B$="?"
5410 GOTO 5140
5420 C$=C$+Z$
5430 RETURN

```

RUN

? A+B	AB+
A+B	
? A+B*C	ABC**
A+B*C	
? A*B+C	AB*C+
A*B+C	
? A*(B+C)	ABC**
A*(B+C)	
? -A+B	A!B+
-A+B	
? -(A+B)*C+(D*E)	AB+!C*DE**
-(A+B)*C+(D*E)	
? -(A+B)*(C-D)	AB+!CD-*
-(A+B)*(C-D)	

A typical output from the above program. The entered algebraic expressions are converted to RPN.

'660 Software

One-handed pong

Upon loading this game, a 'field' of 'spots' appears in the top half of the screen and a 'bat' at the bottom. You can serve up to twenty balls with your bat by pressing any key other than 4 or 6. These keys move the bat left and right respectively. Each spot hit

disappears and you accrue one point per hit. Sound effects are included. You can widen the paddle by changing the E0 byte at 06CD (right at the end of the program) to F8 or FF.

0600	A6 CC	I=06CC	0646	6E 04	VE=04	068C	34 01	SKF V4=01
0602	6A 07	VA=07	0648	EE A1	SKF VE#KEY	068E	64 FF	V4=FF
0604	61 00	V1=00	064A	6C FF	VC=FF	0690	C5 01	V5=RND
0606	6B 08	VB=08	064C	6E 06	VE=06	0692	35 01	SKF V5=01
0608	60 00	V0=00	064E	EE A1	SKF VE#KEY	0694	65 FF	V5=FF
060A	D0 11	SHOW 1MI@VOV1	0650	6C 01	VC=01	0696	16 42	GO TO 0642
060C	70 08	VO+08	0652	D0 11	SHOW 1MI@VOV1	0698	6A 03	VA=03
060E	7B FF	VB+FF	0654	80 C4	VO=VO+VC	069A	FA 18	TONE=VA
0610	3B 00	SKF VB=00	0656	D0 11	SHOW 1MI@VOV1	069C	A6 CB	I=06CB
0612	16 0A	GO TO 060A	0658	4F 01	SKF VF#01	069E	D2 31	SHOW 1MI@V2V3
0614	71 04	V1+04	065A	16 98	GO TO 0698	06A0	73 FF	V3+FF
0616	7A FF	VA+FF	065C	42 00	SKF V2#00	06A2	16 36	GO TO 0636
0618	3A 00	SKF VA=00	065E	64 01	V4=01	06A4	A6 CB	I=06CB
061A	16 06	GO TO 0606	0660	42 3F	SKF V2#3F	06A6	D2 31	SHOW 1MI@V2V3
061C	66 00	V6=00	0662	64 FF	V4=FF	06A8	16 28	GO TO 0628
061E	67 14	V7#14	0664	43 00	SKF V3#00	06AA	A6 CD	I=06CD
0620	A6 CD	I=06CD	0666	65 01	V5=01	06AC	D0 11	SHOW 1MI@VOV1
0622	60 20	V0=20	0668	43 1F	SKF V3#1F	06AE	A6 F0	I=06F0
0624	61 1E	V1=1E	066A	16 A4	GO TO 06A4	06B0	F6 33	MI=V6(3DD)
0626	D0 11	SHOW 1MI@VOV1	066C	A6 CB	I=06CB	06B2	F2 65	VO:V2=MI
0628	63 1D	V3=1D	066E	D2 31	SHOW 1MI@V2V3	06B4	63 18	V3=18
062A	62 3F	V2=3F	0670	82 44	V2=V2+V4	06B6	64 1B	V4=1B
062C	82 02	V2=V2&VO	0672	83 54	V3=V3+V5	06B8	F0 29	I=DSP,V0
062E	77 FF	V7+FF	0674	D2 31	SHOW 1MI@V2V3	06BA	D3 45	SHOW 5MI@V3V4
0630	47 00	SKF V7#00	0676	3F 01	SKF VF=01	06BC	73 05	V3+05
0632	16 AA	GO TO 06AA	0678	16 42	GO TO 0642	06BE	F1 29	I=DSP,V1
0634	FF 0A	VF=KEY	067A	43 1E	SKF V3#1E	06C0	D3 45	SHOW 5MI@V3V4
0636	A6 CB	I=06CB	067C	16 98	GO TO 0698	06C2	73 05	V3+05
0638	D2 31	SHOW 1MI@V2V3	067E	6A 02	VA=02	06C4	F2 29	I=DSP,V2
063A	65 FF	V5=FF	0680	FA 18	TONE=VA	06C6	D3 45	SHOW 5MI@V3V4
063C	C4 01	V4=RND	0682	76 01	V6+01	06C8	16 C8	GO TO 06C8
063E	34 01	SKF V4=01	0684	46 70	SKF V6#70	06CA	01 80	
0640	64 FF	V4=FF	0686	16 AA	GO TO 06AA	06CC	44 E0	
0642	A6 CD	I=06CD	0688	D2 31	SHOW 1MI@V2V3			
0644	6C 00	VC=00	068A	C4 01	V4=RND			



TRS-80* Model II with Line Printer V and Cable, Just \$8067.95*

Get to Your Bottom Line Faster With a Tandy TRS-80 Computer!

A Tandy TRS-80 Model II business system is one of the easiest ways to improve your accounting process. It's also one of the most affordable, with systems priced from only \$5300 to \$13,600. Just add our low-cost, ready-to-run software, and you'll be "in business" fast.

Our Accounts Receivable package can keep track of current and overdue accounts to speed-up collections, identify bad debts, and improve your cash flow. Optimize your payment dates with Accounts Payable. There's a system for

managing retail inventories, and even a specialized one for manufacturers. And General Ledger prepares accurate balance sheets and income statements for fast analysis of your company's profits.

Because TRS-80 Model II is a multi-purpose workstation, you can improve efficiency and productivity in other areas, too. Add our SCRIPSIT™ package for full-featured word processing. Use VisiCalc† for instant "what if . . ." forecasting and planning. Or set up your own customized "electronic filing" system with Profile II. You don't have to be a computer expert, because each programme

has its own easy-to-follow reference manual.

For a personal demonstration of our TRS-80 Model II, visit your nearest Tandy Computer Centre, authorized dealer, or expanded computer department of selected Tandy Electronic Stores.

Tandy
Computer Centre

The biggest name in little computers™

*Retail prices may vary at individual dealer stores. Special order may be required. †TM Personal Software, Inc.

Please send me more information on TRS-80 computers.

Tandy Electronics, Advertising Dept,
PO Box 229, Rydalmere 2116. 110030

Name: _____

Company: _____

Address: _____

City: _____ State: _____

P/C: _____ Tel: _____

There's more to being a burn up at the



For those officers who really want to fly high, there is also a science degree.

At the RAAF Academy you get your Degree through the University of Melbourne and we pay you quite handsomely for the privilege.

But when you graduate as an officer you will have more than a Bachelor of Science. You will also have your pilot's wings and a job waiting for you.

By the time you're 23 the RAAF will have given you an incomparable foundation upon which to build a fulfilling career.

GIVE YOUR CAREER A FLYING START.

With a degree from the RAAF Academy, your career will certainly have a flying start.

However, it takes more than simply a good education to fly a plane. When the F18 breathes fire it could be travelling at up to Mach 1.8 — nearly twice the speed of sound. At speeds like that you can't afford to have your head, as it were, in the clouds. You have to be alert. You have to be able to make split second decisions. And you have to know the aircraft backwards.

That not only takes training. It takes the right mind, and the right temperament. So, if you want to dream, cut out the plane. But if you want to fly, cut out the coupon. Or ring any RAAF Careers Adviser.

So long as you are an Australian Citizen, under 20 on January 1st of your year of entry,

g a pilot than having speed of sound.



and so long as you're matriculating this year or have already matriculated and meet our selection requirements you're eligible for entry.

However, if you matriculate next year you could be eligible for a scholarship to help you through. Just tick the appropriate box.

MELBOURNE	(03) 61 3731
SYDNEY	(02) 212 1011
CANBERRA	(062) 82 2333
PERTH	(09) 325 6222
ADELAIDE	(08) 212 1455
HOBART	(002) 34 7077
BRISBANE	(07) 226 2626

The RAAF Academy, Pt. Cook. It's the one place where you will literally give your career a flying start.



Application forms are available now.
Send to: Air Force Careers Office,
GPO Box XYZ, in your State
Capital

I would like more information on:
☐ The RAAF Academy, Point Cook
☐ The RAAF Academy Scholarship

Name

Address

..... Postcode

Birthdate

Air Force Officer.

Authorised by the Director General of Recruiting, Department of Defence

AFA7-DPS-111

minitool

MADE IN W. GERMANY



WORKSHOP KIT 000-62-90 X—Carry case, Power supply, Pistol drill, Drill stand, Orbital sander, Jig saw, flexible Shaft unit, spare Blades, Table clamp, Platform table. R.R.P. ~~\$250~~ \$187.50

SPECIAL PRICES!!

WORKSHOP KIT 000-62-90 Y—Same as above but not including flexible Shaft unit. R.R.P. ~~\$195~~ \$149.50

BULK SHIPMENTS



\$37.00

JIG SAW

000-62-108
5000 strokes/min.
Platform table incl.
in kit. Extra as individual item.

**MAIL ORDER OR CALL IN
all items ex-stock**

ORBITAL SANDER

000-62-206
5000 strokes/min.

\$37.00



POWER SUPPLY

240v Plug-pak.
12v output, 1 amp.

\$15.00

PERFORMANCE TOOLS – NOT TOYS!!

PISTOL DRILL

000-62-402
7000 R.P.M.
Drill capacity
·08 – 6mm

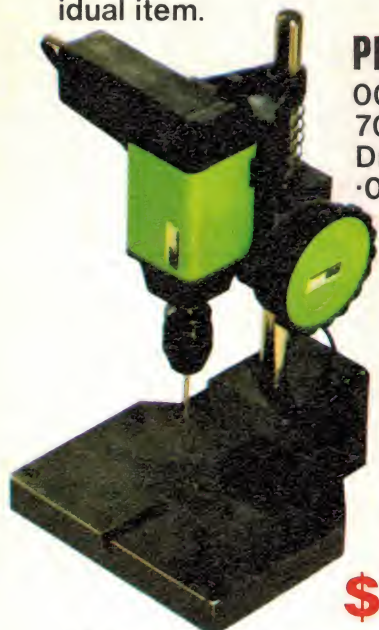
\$37.00

ESSENTIAL FOR –
electronics
jewellery
arts & crafts
model building
restricted access
engineering

ANGLE GRINDER

000-63-605
7000 R.P.M.

\$45.00



DRILL STAND

000-62-493
Accepts Pistol Drill
& Angle Grinder.
(Use saw blades for
cutting.)

\$37.00

All units warranty 6 months



FLEXIBLE SHAFT & GRINDSTICK

000-62-804
7000 R.P.M.

\$45.00

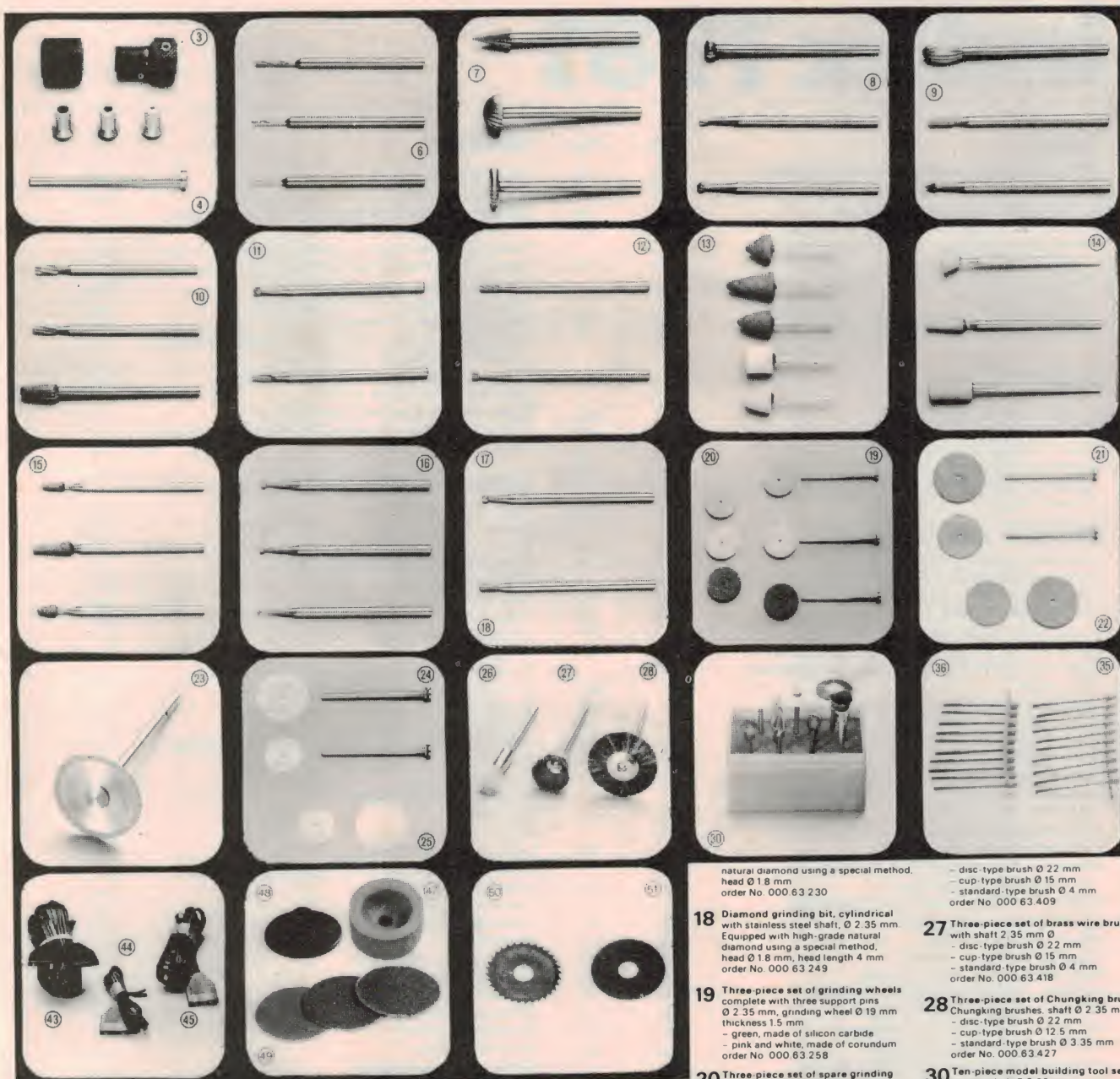
Ideal for miniature & electronic engineering. A 'must' for the modelmaker.

SEND S.A.E. FOR
FULL PRICE LIST

MINITool AUSTRALIA PTY. LTD.

134A AYR ST. DONCASTER VIC. 3108 PH. 850 9887

ACCESSORY RANGE ♦



3 Three-piece chuck set with brass insert for 1/2, 4/ and 3 mm Ø
order No. 000 62 886

4 Support piece suitable for the above interchangeable equipment. Shaft made of stainless steel Ø 2.35 mm
order No. 000 63 507

6 "Mikro" three-piece set of twist drill bits made of high-grade special steel, shaft Ø 2.35 mm, bit Ø 5/0.7/0.8 mm
order No. 000 63 007

7 Three-piece milling set shaft Ø 3 mm - conical with sharp tip, coarse-toothed head Ø 5.8 mm, head length 10.8 mm - semi-circular, coarse-toothed head Ø 9.9 mm, head length 4.9 mm - pinion-type, coarse-toothed head Ø 9.9 mm, head length 2.3 mm
order No. 000 62 457

8 Three-piece milling set made of high-grade special steel, shaft Ø 2.35 mm - circular, coarse-toothed, head Ø 2.3 mm - conical, coarse-toothed, head Ø 2.3 mm, head length 2 mm - oval, coarse-toothed, head Ø 4 mm, head length 2.1 mm
order No. 000 63 105

9 Three-piece milling set made of high-grade special steel, shaft Ø 2.35 mm - oval, coarse-toothed head Ø 0.5 mm, head length 9.8 mm - pointed, coarse-toothed head Ø 2.3 mm, head length 3.1 mm

- cylindrical, coarse-toothed with cross stroke head Ø 2.3 mm, head length 6.2 mm
order No. 000 63 114

10 Three-piece milling set made of high-grade special steel, shaft Ø 2.35 mm - cylindrical, coarse-toothed head Ø 2.3 mm, head length 6.1 mm - conical, coarse-toothed head Ø 2.3 mm, head length 6.4 mm - bud shaped, coarse-toothed head Ø 5 mm, head length 10 mm
order No. 000 63 123

11 Two-piece carbide drilling set made of high-performance carbide, shaft Ø 2.35 mm - circular, coarse-toothed head Ø 2.3 mm - conical, coarse-toothed head Ø 1.8 mm, head length 5 mm
order No. 000 63 132
Illustration at next page.

12 Two-piece carbide drilling set made of high-performance carbide, shaft Ø 2.35 mm - cylindrical, coarse-toothed head Ø 1.8 mm, head length 5 mm - conical, coarse-toothed head Ø 1.8 mm, head length 1.6 mm
order No. 000 63 141

13 Five-piece set of grinding bits head made of corundum, shaft Ø 3 mm - conical with attachments head Ø 14.9 mm, head length 15.8 mm - conical, head Ø 13.6 mm, head length 18.1 mm

- bud shaped, pointed head Ø 13.6 mm, head length 20.4 mm - cylindrical head Ø 13.4 mm, head length 13.3 mm - bud shaped, blunt head Ø 13.2 mm, head length 15 mm
order No. 000 62 448

14 Three-piece set of grinding bits head made of corundum, shaft made of steel, nickel-plated, stainless, shaft Ø 2.35 mm - trapezoidal, head Ø 7.5 mm, head length 5.2 mm - conical head Ø 4 mm, head length 10.7 mm - head Ø 6.4 mm, head length 12.1 mm
order No. 000 63 203

15 Three-piece glass grinding set for surface grinding of glass. Head made of silicon carbide, shaft made of steel, nickel-plated, stainless, Ø 2.35 mm - conical, short head Ø 2.6 mm, head length 6.1 mm - conical, long head Ø 3.7 mm, head length 10.8 mm - bud shaped, pointed head Ø 3.1 mm, head length 5.8 mm
order No. 000 63 212

16 Three-piece glass cutting set for cutting contours on glass. Head with natural diamond, shaft made of stainless steel Ø 2.35 mm, head Ø 1/1, 1/4/1.6 mm
order No. 000 63 221

17 Diamond grinding bit, circular with high-grade steel shaft, stainless Ø 2.35 mm. Equipped with high-grade

natural diamond using a special method, head Ø 1.8 mm
order No. 000 63 230

18 Diamond grinding bit, cylindrical with stainless steel shaft, Ø 2.35 mm. Equipped with high-grade natural diamond using a special method, head Ø 1.8 mm, head length 4 mm
order No. 000 63 249

19 Three-piece set of grinding wheels complete with three support pins Ø 2.35 mm, grinding wheel Ø 19 mm thickness 1.5 mm - green, made of silicon carbide - pink and white, made of corundum
order No. 000 63 258

20 Three-piece set of spare grinding wheels, without support pin, grinding wheel Ø 19 mm, thickness 1.5 mm - green, made of silicon carbide - pink and white, made of corundum
order No. 000 63 267

21 Two-piece set of friction discs complete with two support pins Ø 2.35 mm, friction discs made of corundum - Ø 22 mm, 0.8 mm in thickness - Ø 25 mm, 1.0 mm in thickness
order No. 000 63 276

22 Two-piece set of spare friction discs without support pins, friction discs made of corundum - Ø 22 mm, 0.8 mm in thickness - Ø 25 mm, 1.0 mm in thickness
order No. 000 63 285

23 Diamond friction disc with support pin made of stainless steel Ø 2.35 mm. Equipped with high-grade natural diamond using a special process. Ø 18 mm, 0.7 mm in thickness
order No. 000 63 294

24 Two-piece set of circular saw blades made of special stainless steel Ø 2.35 mm, saw blade Ø 16/22 mm
order No. 000 63 301

25 Two-piece set of spare circular saw blades, without support pins, made of special stainless steel, saw blade Ø 16/22 mm
order No. 000 63 310

26 Three-piece set of steel wire brushes with shaft Ø 2.35 mm

- disc-type brush Ø 22 mm - cup-type brush Ø 15 mm - standard-type brush Ø 4 mm
order No. 000 63 409

27 Three-piece set of brass wire brushes with shaft Ø 2.35 mm - disc-type brush Ø 22 mm - cup-type brush Ø 12.5 mm - standard-type brush Ø 4 mm
order No. 000 63 418

28 Three-piece set of Chungking brushes Chungking brushes, shaft Ø 2.35 mm - disc-type brush Ø 22 mm - cup-type brush Ø 12.5 mm - standard-type brush Ø 3.35 mm
order No. 000 63 427

30 Ten-piece model building tool set all with shaft Ø 2.35 mm - Three corundum grinding bits - Three milling bits - Two brushes, plastic - One felt disc on support pin - One circular saw on support pin
order No. 000 62 439

35 Saw blades for jigsaw, set of ten, coarse order No. 000 62 144

36 Saw blades for jigsaw, set of ten, fine order No. 000 62 144

43 3 m extension lead order No. 000 62 091 - without illustration -

44 Transformer adapter order No. 000 62 073 - without illustration -

45 Car adapter 12 volt order No. 000 62 073 - without illustration -

47 Cup grinding wheel made of corundum Ø 32 mm, complete with mount order No. 000 63 623

48 Grinding disc, set of three, Ø 40 mm order No. 000 63 632

49 Sandpaper, self-adhesive, circular, set of ten. Assorted fine, medium and coarse, Ø 40 mm order No. 000 63 641

50 Saw blade for wood Ø 32 mm, complete with mount order No. 000 63 669

51 Saw blade for metal Ø 32 mm, complete with mount order No. 000 63 678

index 1981

AUDIO

	Date	Page
High-performance audio power amp (L. Stellema)	Nov	158
Inside Quad's latest electrostatic loudspeaker (B. Dance)	Dec	140
Loudspeakers in the round (B. Dance)	Mar	128
New trends in loudspeaker testing (L. Challis)	Feb	122
Optical disc recorders — death blow for present day turntables? (A. Concannon)	Jun	142
The Series 4000/1 4-way loudspeakers — a personal revamp (G. Pennington)	Jul	131
THD analyser for audio circuits (L. Tunncliffe)	Aug	139
A visit to Audio-Technica (L. Challis)	Jan	118

COMPUTERS

Advanced BASIC Part 1 (P. Cohen)	Jun	119
Advanced BASIC Part 2 (P. Cohen)	Jul	105
Advanced BASIC Part 3 (P. Cohen)	Sep	90
Advanced BASIC Part 4 (P. Cohen)	Nov	132
Alphasort — a program to sort alphabetical information	Sep	88
Anadex DP9500 Printer (E. Ray)	Aug	114
Back Door into BASIC Part 2 (P. Cohen)	Jan	87
Back Door into BASIC Part 3 (P. Cohen)	Feb	94
Back Door into BASIC Part 4 (P. Cohen)	Mar	108
Back Door into BASIC Part 5 (P. Cohen)	Apr	99
Behold — the bubble memory! (B. Dance)	Mar	89
The big Apple (P. Cohen)	Feb	84
Cosmac VIP-111 (P. Cohen)	Apr	77
Dick Smith System 80 — Review (P. Cohen)	Jul	93
Faster than a speeding bubble sort... it's shellsort! (A. Daviel)	Oct	126
Fast plotter for the TRS80 (A. Lacy)	Jun	129
Home computers set to storm market	Oct	83
How to hex your UK 101 (M. Croft)	Sep	99
Inside the Instructor 50 (J. Phillips)	Apr	110
Keyboard beeper for the Exidy Sorcerer (G. Wideman)	Dec	118
A learner's microcomputer Part 1 (Project 660) (H. Anderson, G. Teesdale)	May	94
A learner's microcomputer Part 2 (Project 660) (H. Anderson, G. Teesdale)	Jun	103
A learner's microcomputer Part 3 (Project 660) (H. Anderson, G. Teesdale)	Oct	100
A learner's microcomputer Part 4 (Project 660) (H. Anderson, G. Teesdale)	Nov	25
Life on a 6800 (E.J. Pepper)	Sep	112
Lilliput computers (T. Moffatt)	Jan	68
Newton's cool (J.D. Lee & T.D. Lee)	Dec	86
PET talk — BASIC optimisation (D. Bolton)	Sep	96
PET talk — double density (P. Williams)	May	112
PET talk — memory test (K. Townsend)	Nov	128
POKEing on the ZX80 (M.E. Bryant)	Apr	85
— More POKEing on the ZX80 (M.E. Bryant)	May	115
Programming in CHIP-8 — a crash course (P. Cohen)	Nov	115
Reliable cassette recorder for your computer (G. Wideman)	Sep	105
Spellguard — every proofreader's dream	Jul	98
Talking computers — a new hope for the blind (A. Concannon)	Jun	112
Touch-typing tutor (M. Banthorpe)	Jul	90
Uncovering the Z80	Apr	87
Universal logic (C.L. Boltz)	May	101
Vector Graphic's VIP (E. Ray)	Jun	90
What is CP/M? (P. Cohen)	Oct	118
Wordsquare — a game for the TRS80 (A. Lacy)	May	108
"You'll have a Shandy, then?" — Tandy/Sharp pocket printer (T. Moffatt)	Nov	122
ZX80 renumber program (A. Beasley)	Sep	100
ZX80 Nim (J. McCartney)	Aug	125

ELECTRONIC TECHNIQUES

A good joint is hard to find (soldering) (R. Harrison)	Oct	18
High-performance audio power amp (L. Stellema)	Nov	158
Liquid crystal displays (R.C. Moorshead)	Jun	35
New trends in loudspeaker testing (L. Challis)	Feb	122
THD analyser for audio circuits (L. Tunncliffe)	Aug	139
Universal logic: more potential in the chip (C.L. Boltz)	May	101

GENERAL

1980 electric moped race	Feb	16
Electronics devotees will find Data '81 a treat	Aug	101
Electronics distance measurement for industrial and scientific applications (D.E. Smith)	Aug	15
Electrostatic discharge — nemesis of electronic systems	Jun	14
A good joint is hard to find (soldering) (R. Harrison)	Oct	18
The Holy Shroud of Turin (J. Clarke)	May	14
Liquid crystal displays (R.C. Moorshead)	Jun	35
Magnetic levitation for future transport?	Nov	16
The negative ion generator — product of the future or no future for the product (D. Warring)	Apr	15
Police radar traps are not infallible (J. Brereton)	Mar	14
Radar for the blind (J.W. Park)	Jul	14
Superconducting magnetic sensors	Jul	22
Talking computers — new hope for the blind (A. Concannon)	Jun	112
A visit to Audio-Technica (L. Challis)	Jan	118

IDEAS FOR EXPERIMENTERS

Alarm power supply	Jan	59
Bi-directional audio link	Aug	70
Burglar alarm cum water level detector	Jan	56
Broadcast booster for AM band DXers	Jun	72
Cheap micro music box	Jul	68
Copy pcb designs	Mar	62
Easy-lift lid	Mar	60
ETI-084 car alarm mods	Jul	71
ETI-480 amp module — barefoot & bridged	May	70
ETI-606 tuning fork mods	Dec	54
ETI-640 VDU mod. cures 'interlace jitter'	Jun	75
'Heads or tails' — electronic decision maker	Nov	79
Identify IC pins with ease	Apr	63
Improving performance of the 8038 function generator	Feb	59
Improving the ZX80 cassette interface	Aug	73
'Jury-rig' intercom	Jan	56
Keeping coil slugs in place	Feb	60
LED chaser	Mar	62
LED S-meter	Feb	63
Logic probe mimics H-P unit	Jan	59
Meter for the ETI-560 mains cable seeker	Jun	75
Micropower LED flasher	Aug	70
Over-rev safety cutout	Feb	59
Parametric equaliser	Jul	71
Power monitor	Mar	60
Quick and easy front panels	Jun	75
Quick transistor checker	Nov	76
Remote control with UARTs	May	73
Simple anemometer	May	70
Simple burglar alarm	Feb	60
Simplest intercom	Nov	76
Simple photographic timer	Aug	73
Simple square wave generator	Mar	62
Simple timer	Dec	58
Simplest triac light dimmer	Jun	72
Solid-state audio switch	Dec	58
Variable temp. controller	Feb	63
VCO for the ETI-450 bucket brigade delay line	Feb	60
Video buffer for the ZX80	Dec	58
Visual beat for ETI-604 metronome	Jun	75
VLF ramp generator	Jul	68
Water level sensor and switch	Dec	54
Zap! Pow! Zeep, zeep! — Vapourise those Cylons	Apr	63

LAB NOTES

Attenuator ups and downs (R. Marston)	Jul	63
Don't go off about Schmitt triggers — look at the 4093!	Mar	55
Gate, square, sine, modulate — with the 555 and 7555 (R. Marston)	May	64
A look at the versatile 4046B (R. Marston)	Nov	65
Remote control systems (R. Marston)	Aug	57
Safety with CMOS (R. Marston)	Jun	61
The tender touch	Sep	50
Using the LM396 10A adjustable voltage regulator	Dec	42

PRODUCT TESTS

Audio Technica ATH8 stereo headphones	Sep	148
B&W DM10 loudspeakers — class in a small package (L. Challis)	Sep	140

B&W 801 loudspeakers (L. Challis)	Feb	144
The big Apple (P. Cohen)	Feb	84
Building a Sabtronics bench DMM	Aug	67
Carver M400 magnetic field power amp (L. Challis)	Nov	166
Cosmac VIP-111 (P. Cohen)	Apr	77
DCM 'time window' loudspeakers (L. Challis)	Jan	132
Dick Smith's alternative — the System 80 (P. Cohen)	Jul	93
Dick Smith's P-360 turntable (L. Challis)	May	136
Dynaudio model 20-55 two-way speaker system (L. Challis)	Nov	174
Example of new concepts — Pioneer TX-710 AM/FM tuner (L. Challis)	Jul	140
Fosgate amplifier for superb motoring sound (L. Challis)	Oct	146
Inside the Instructor 50 (J. Phillips)	Apr	110
Jands J1000 amp (L. Challis)	Oct	154
Kenwood KR-80 receiver — maxi in a mini body (L. Challis)	Apr	132
Lilliput computers (T. Moffat)	Jan	68
A look at the Anadex DP-9500 printer (E. Ray)	Aug	114
Marantz 'Esotec' SM1000 stereo amp (L. Challis)	Jun	154
Marantz Tt1000 turntable (L. Challis)	Apr	146
Nakamichi's flagship — the 1000ZXL cassette deck (L. Challis)	Feb	134
Nakamichi 480Z cassette deck (L. Challis)	Aug	148
The Optonica RP7100 — a new concept in turntable convenience (L. Challis)	Mar	144
Permostat anti-static record preservative kit	Jan	124
The Sansui SE-8 graphic equaliser/analyser (L. Challis)	Dec	150
Sanyo Plus 75 receiver — high-powered sound (L. Challis)	Jun	148
Sony TA-F80 amplifier (L. Challis)	May	122
Technics RS M51 cassette recorder (L. Challis)	Mar	134
Vector Graphics VIP (E. Ray)	Jun	90
"You'll have a Shandy, then?" — Tandy/Sharp pocket printer (T. Moffat)	Nov	122

PROJECTS

154	Five-mode logic pulser probe (P. J. Jones)	Jul	53
155	High-power 'dummy-loads' for audio amplifier testing (A. Kay & R. Harrison)	Jun	53
156	High-impedance instrument probe features 100 MHz bandwidth (J. Scott)	Jun	30
157	Crystal marker generator for receiver and CRO calibration (R. Marston, S. Campbell)	Oct	63
158	Test meter measures resistance from 100 ohms down to 0.005 ohms (R. Marston, S. Campbell)	Nov	55
159	Expanded scale voltmeter covering the 10-15 V range (R. Harrison, S. Campbell)	Dec	37
256	Electronic humidity meter can double as a controller (G. Teesdale)	May	46
257	'Universal' relay driver board (G. Teesdale)	May	53
258	A simple speed regulator for miniature dc electric drills (G. Teesdale)	Jul	47
328	Build a LED oil temperature meter for your vehicle (P. Wait, S. Campbell)	Jan	39
329	Expanded scale vehicle ammeter (J. Scott)	Feb	19
330	'Current trip' car alarm features exit/entry delay and no false alarms (P. Wait)	Jul	31
332	Versatile electronic stethoscope (R. Marston, S. Campbell)	Aug	30
458	Series 5000 LED level meter features simultaneous peak and average display plus 60 dB dynamic range (D. Tilbrook)	Jun	42
477	MOSFET power amp Part 1 (D. Tilbrook)	Jan	20
477	MOSFET power amp Part 2 (D. Tilbrook)	Feb	26
477	Series 5000 MOSFET stereo amp (D. Tilbrook)	Mar	30
478	Series 5000 stereo control preamplifier Part 1 (D. Tilbrook)	Jul	25
478	Series 5000 stereo control preamplifier Part 2 (D. Tilbrook)	Sep	20
478	Series 5000 stereo control preamplifier Part 3 (D. Tilbrook)	Oct	33
567	A portable electronic core-balance relay	Apr	36
596	Audio 'white noise' generator employs digital technique	Nov	48
598	Touch switch can select up to ten outputs in sequence (P. Wait)	Feb	44
599	Infrared remote control unit (P. Wait, S. Campbell)	Apr	47
1500	Notes for constructors of the ETI 1500 metal detector	Apr	43
1501	Experimental negative ion generator (J. Scott, G. Teesdale)	Apr	30
1503	An 'intelligent' battery charger (J. Scott)	Aug	38
607	Simple sound effects Part 1 (P. Wait)	Aug	47
607	Simple sound effects Part 2 (P. Wait)	Sep	44
660	A learner's microcomputer Part 1 (G. Teesdale)	May	94
660	A learner's microcomputer Part 2 (G. Teesdale)	Jun	103
660	A learner's microcomputer Part 3 (G. Teesdale)	Oct	100
660	A learner's microcomputer Part 4 (G. Teesdale)	Nov	25

682	S100 PROM board includes many features (C. Barratt)	Mar	99
685	A single-board computer using the 2650 on an S100 card (R. Koenig)	Dec	91
727	A 'universal' antenna matcher for shortwave reception (S. Campbell, P. Wait)	Jan	47
728	UHF TV antenna (J. Gerassimon)	Mar	41
729	Masthead amp for UHF TV (P. Wait)	Apr	58
735	UHF to VHF TV converter (P. Wait)	May	35
760	Video RF modulator (G. Teesdale)	Oct	57
824/5	Slot car controllers (J. Scott)	Dec	26

SCIENCE

Bio-electronic prospects (Dr J. Barker)	Jan	14
Electrostatic discharge — nemesis of electronic systems	Jun	14
Encounter with Saturn (B. Dance)	Apr	24
Galileo modified (A. Rennie)	Mar	25
The negative ion generator — product of the future or no future for the product? (D. Warring)	Apr	15
Particle beam fusion (B. Dance)	Dec	14
Scientific examination of the Turin Shroud (B. Dance)	May	25
Seeking the gluon (B. Dance)	Jun	26
Superconducting magnetic sensors	Jul	22

SHORT CIRCUITS

Boost the output of your portable radio cassette	Jul	129
Crystal calibrator for shortwave	Apr	41
CMOS logic probe	Jun	41
Computer 'back-up' supply (E. Williams)	Aug	111
Go/No Go transistor check	Mar	51
Headphone amplifier	Mar	142
Hold that note! Guitar sustain unit	Mar	46
Memory-mapped sound generator (W. S. Maggs)	Sep	103
'Photocell' switch is activated by change in light level	Jul	41
Simple LED VU meter covers 20 dB range in six steps	May	134
Six-range FET dc voltmeter has 11M input impedance	Feb	55
Slide/tape synchroniser	Aug	145
A 'sniffer' for the two-metre hidden transmitter units (R. Harrison)	Jan	96
Stereo balance meter (G. Durant)	Jul	139

VIDEO

Blank tape levy — inquiry urged (B. Dance)	Dec	127
The flat pocket TV — available soon?	Oct	14
Game, set, match (D. Lingane)	Sep	16
Thrust and parry in the video war (D. Lingane)	Apr	137
Video battle in full swing while audio regroup (D. Lingane)	Sep	128
Videodisc — waiting in the wings (B. Dance)	May	129

NOTES AND ERRATA 1981

January '81, Lilliput Computers: There is a typographical error in the program listings on page 73. In the 'Great Circle' program, line 720, JSD=DEG D, should read JS:D=DEG D. In line 750, the 'COX' in the equation should be COS.

March '81, Ideas for Experimenters: A rather obvious, but potentially dangerous error occurred in the circuit on the top left of page 60 ('Power Monitor') in the March issue. It shows the mains active input connected to the earth at the output. The mains active input should instead go to the fuse. Correct your copy now. Correction slips were inserted in the majority of copies distributed.

February-March '81, Back Door Into BASIC: In February, p.95, Figure 3: Table entries have variable subscripts in reverse — e.g. E(2,1) should be E(1,2). In March, p.113: In the centre column, the 16th line from the bottom should read "result of 'A*A=3*3 and A*0' will be". In March, page 109: Line 90 should be 'R=V3/I'.

March '81, The Negative Ion Generator: The caption beneath the chart at the top right of page 17 contains an error. The fourth line should read "... balanced positive-to-negative ion ratio of 1.2:1.0 . . .".

May '81, Wordsquare — game for the TRS80, p. 108: This program was obtained from our UK proteges and contains an error we didn't spot — brought to our attention by P. Chapman of Auckland, N.Z. Line 550 of the Program Listing should read
550 SS(R2(I), C2(I))=MID\$(WS(W1),I,1)
and all should be well.

Lab Notes, July, pages 63-65: This article was reprinted from our British counterpart and, while predominantly accurate, something has gone seriously amiss at the end following the heading 'Matched-resistance attenuators'. The article at this point is quite wrong. It would take too much space to correct the problem here, so we suggest you ignore this section, which includes Figures 8 and 9. We have not had difficulties with Ray Marston's material previously, and while material is generally checked for accuracy, drawing and typographical errors, etc, this one slipped through.

Programming in CHIP-8, Nov. '81: The procedure for loading on cassette (in box, p. 116) has an omission. The load procedure should read:

'RESET'	'06'	'STEP'
'0'	'STEP'	'25'
'STEP'	'00'	(or you could put FF here)
'0400'	'STEP'	'RESET'
'STEP'	'07'	'4'

Project 159, Dec. '81: On page 37, the text mentions Project ETI-316, where we mean the ETI-326, published in the September '80 issue.

Project 477, Jan. '81: In the circuit diagram for the ETI-477 MOSFET Power Amp Module, page 24, capacitors C7 and C8 were shown connected between the gates of Q9 and Q11 respectively, and the feedback line. In fact, they connect between the gate and source of each device, as shown in the Feb. issue.

In the February issue, under How it Works, there is a typographical error in the second last sentence, third column. It reads "Transistors Q4 and Q5 therefore form the main voltage gain section of the amplifier . . .". It should read "Transistors Q6 and Q8 . . .".

The ETI-477 MOSFET amp is not unstable if you build it the way we described. However, some readers have reported difficulties with the amplifier going into high frequency oscillation. There are two reasons for this. If capacitor C9 (220n greencap) has a high self-inductance it will not look like a capacitor, the amplifier output will be unloaded at high frequencies and oscillation will result. We found 'Elna' 630 V greencaps have a low inductance and the amp is not unstable using them.

Secondly, if resistors R25 and R27 have more self-inductance than the 'Noble' types we used, then the output stage may be unstable. There are two cures for this one. Either replace R25 and R27 with Noble types or connect a 47n greencap between the sources of Q9 and Q11. This is best done on the copper side of the board, mounting the capacitor between the two pads where the leads of each resistor go to the sources of Q9 and Q11.

Project 567, April '81: On page 38 is the pc board for the ETI-567 Core-Balance Relay. Just in case you hadn't noticed, look carefully and you'll see the writing on the potcore and the transformer is laterally reversed. The picture is shown correctly on page 12 of the May '81 issue.

That wasn't the only thing the wrong way round. The two red wires from T2 (L1) are shown incorrectly on the overlay, page 39. Transpose them for correct operation. The How it Works is correct, but the dot on the top wire of L1 on the circuit should go on the lower wire.

A reader has drawn to our attention a problem he experienced when using the core-balance relay with a long lead plugged into its output where a number of fluorescent lights were operating nearby. The core-balance relay would not trip on test with loads over about 25 watts. On investigation, he found severe RF noise, generated by the fluorescent lights, was preventing the unit's trip circuit from functioning. Looking at each end of L3 (secondary of T2, the sense transformer) using an oscilloscope, he found high amplitude noise on each, but of markedly differing amplitudes. The cure is simple — a 4n7 capacitor connected directly across L3. The unit still functions as designed, even with highly inductive loads plugged into the output. Our thanks to Bill Waters for passing that on.

ETI-660 Learner's Micro, Nov. '81: In the circuit diagram on page 37 the data buss lines adjacent to pins 26 to 33 of IC5 are shown in reverse order; D0 goes to pin 26, D7 to pin 33. This reverses the data out signals from the 6821, but it's all taken care of, so do not worry, my little chickens. Note that, on page 39, the circuit shows the 1864 as IC3 when we all know damn well that it's actually IC4.

On overlay drawings numbers 4 and 5, pages 31 and 32, IC20 is shown as a type 74LS00. It should be 7475. Also, on overlay drawing #5, p.32, the link near IC8 is shown as LINK 2 when it should be LINK 3. On the circuit, pages 36-37, the designations for diodes D5 and D6 are reversed. The upper diode is D6. The note relating to D5, D6 is correct.

Project 685, 2650 S100 Computer; December '81: In the parts list, the power supply input bypass tantalum capacitors were erroneously specified as 6 V types. They should be 35 V types — these are capacitors C2, C4 and C5. Also capacitors C1 and C9 may be 6 V or 10 V tantalums, but capacitors C6 and C7 should be 15 V or 25 V types.

ETI-728 UHF TV antenna, March, pages 41-43: The text states the folded dipole was constructed of aluminium strips 3 mm thick by 12 mm wide, while the diagram on page 43 shows the width to be 25 mm. It is in fact 25 mm wide, but this dimension is not critical and either strip width will work.

Project 824, Dec. '81: The power transistor, Q1, used in the Slot Car Power Supply is an MJ2955, not a 2N2955. On the overlay, page 29, R3 is shown as 830R, but is really an 820R, as in the circuit and parts list.

Series 5000 Preamp, Oct. '81: The 400 Hz oscillator set-up procedure is as follows, not as per page 12 in Dec. '81. Take your multimeter, set to read ac volts, and connect it to one of the output sockets. Set the TAPE switch to OSC. and adjust RV4 to obtain 1.2 Vac (RMS) on the meter.



National

A NEW WAVE IS ON THE HORIZON

Available in four models these low cost oscilloscopes feature:

- * 15-20-30 MHz.
- * 1mV/Div sensitivity
- * Stable automatic trigger 'AUTO FIX'
- * Full range of triggering mode
- * Bright and sharp CRT with Auto Fix
- * TV(V) and TV(H) sync separator circuit
- * Rectangular tube, illuminated internal graticule (VP-5220A and VP-5231A)
- * Built-in delay line for observation of pulse transient (VP-5231A only)
- * High reliability - MTBF 15,000 hours

National have a wide range of scopes - to 300 MHz. Please call or write for further information

..FROM \$389 - 00 (NOT INC. S.T.)

Probes supplied as standard accessory



SCIENTIFIC DEVICES AUSTRALIA PTY. LTD.

2 JACKS ROAD, SOUTH OAKLEIGH, VICTORIA, 3167 TELEPHONE: 579 3622
P.O. BOX 63, SOUTH OAKLEIGH, VIC. 3167 TELEX: AA32742
CABLES: DEVICES MELBOURNE

bankcard
welcome here

SIGHT & SOUND

Satellite-to-home TV receiver — development promises low cost

Home television sets could soon be picking up broadcasts directly from satellites. Scientists in France have designed a low-cost microwave receiver that will need only a low-cost 1 m antenna to be commercially feasible.

The research effort was stimulated by experiments with the European Orbiting Test Station and the Japanese satellite Yuri, which confirmed that high-power geostationary craft transmitting at 12 GHz could provide sufficient signal-to-noise ratio for a quality picture.

To gather further data on the concept, France and Germany plan a joint 1984 launch of two preoperational 12 GHz satellites.

The envisioned system will comprise outdoor and indoor units, according to the design from the Laboratoires d'Electronique et de Physique Appliquee in Limeil-Brevannes, near Paris. The heart of the outdoor unit is an amplifier — actually a gallium arsenide metal-semiconductor field-effect transistor (MESFET) — that is not only state-of-the-art but by now is also practical for the consumer market.

The high-cost, high-technology requirements for satellite-to-home TV broadcasting have been designed into the satellite side of the link, so that the specifications on the receiver end are relaxed — cutting the consumer's cost considerably.

Although cost counts, the absolute measure of any receiver is its capacity to present high-quality TV pictures on a standard TV set. Subjective as this criterion may be, it can in fact be defined in terms of a measurable signal-to-noise ratio at the TV receiver's figure of merit, which is given as 16 dB. Consequently, the minimisation of the noise figure of any 12 GHz down-converter is fundamental to the receiver's performance.

There are four basic functions performed in the receiver's front end. These are 12 GHz filtering and low-noise amplification (which is

optional), 11 GHz stable oscillation, conversion from 12 GHz to 1 GHz, and 1 GHz IF amplification. One system design option involves the use of the same active component to perform all three radio frequency functions.

In the Philips systems, MESFETs are used in the low-noise amplifier, the mixer, and the local oscillator. In each function, the single-gate MESFET presents particular advantages. It offers low noise in the amplifier stage, conversion gain in the mixer, and excellent temperature stability in the local oscillator.

The local oscillator is particularly steady when it is stabilised with a barium titanate dielectric resonator with the added compensating technique of voltage-controlled output power.

The unit is housed in a moulded, metalised plastic shell. The moulding approach was adopted to minimise the hardware's price and remains relatively simple since no temperature control is necessary inside the front end.

Current front-end receiver research, at LEP and elsewhere, is directed towards a monolithic version of the FET front end, where all the active components and some RF circuitry will be integrated on the same GaAs chip. This greatly reduces mounting and adjustment time and eliminates other time-consuming assembly operations.

This approach is conceivable today because of progress in GaAs techniques that can create large and reproducible GaAs wafers. However, the cost and material limitations of high-Q circuits, temperature-stable material, GaAs real estate costs and production yield are considerations that ultimately will determine the degree of monolithic integration.



The 1 m dish soon to be a common suburban sight?

Solid-state compact video camera

The Sharp Corporation has developed a lightweight, compact and easy to operate solid-state video camera incorporating LSI technology.

Conventional video cameras use a pick-up tube (a kind of vacuum tube), which poses the following problems:

- the pick-up tube is long, thus increasing the camera's size.
- high power consumption needs frequent battery replacement.
- true colour reproduction is impossible when videotaped under low illumination (100 to 200 lux).

Sharp has now developed a semiconductor device that replaces the conventional pick-up tube by using VLSI and opto-semiconductor technology.

This semiconductor device contains approximately 200 000 picture elements on a 10 mm x 8.4 mm silicon semiconductor chip. Called CCD (Charge Coupled Device), it converts a light signal into an electric signal.

A video camera using this CCD is said to feature:

- compactness and light weight, providing easy operation equal to that of an ordinary camera.



- true colour reproduction is possible even when videotaping under low illumination (approx. 60 lux interior brightness).
- no picture distortion, residual image or sticking occurs.
- the semiconductor ensures stable pictures even when subjected to vibration or shock.
- semiconductor mass production will result in future cost reduction.

The Sharp Corporation in Australia says it is too early to predict when the unit will be available.



Smaller and smaller . . .

M-G1 is one of the latest additions to Sanyo's range of portable sound systems. It is only slightly larger than the cassette tape itself, and is said to produce hi-fi performance similar to many larger tape players.

The 'Super Anti-Rolling Mechanism' ensures constant tape speed, even when subjected to rapid movement, and other features include a 'soft-touch' play control, metal tape compatibility, pitch, balance and volume controls, mute switch, and provision for two headphone inputs. Lightweight, comfortable headphones deliver

powerful sound, and a separate battery case is also provided. Power is supplied by two AA size batteries.

M-G1 is available now at a recommended retail price of \$166. For further information contact Mr. W. Fabiszewski, Sanyo Australia Pty Ltd, 225 Miller St, North Sydney NSW 2060. (02)436-1122.

NAD from Falk

Falk Electrosound have available the latest NAD Series 3000 amplifiers and Series 4000 tuners (...those designations seem familiar . . . Ed.) featuring matt black or matt silver finish.

All equipment comes with a five-year warranty — fast becoming an industry standard — and matching styling. There are four Series 3000 amplifiers ranging from 30 W to 90 W output, with low distortion figures specified. There are two Series 4000

tuners featuring good sensitivity and low distortion. All equipment includes conventional meters.

Full details obtainable from Falk Electrosound, P.O. Box 234, Rockdale NSW 2216. (02)597-1111.

Denon's 'ultimate turntable'

Although the specifications of many state-of-the-art turntables are excellent, external factors still play a big part in turntable performance. The problem of acoustic feedback, for example, is sometimes one of the last barriers to perfect reproduction, occurring when the sound coming through the speakers hits the turntable and the vibration is picked up by the sensitive top-grade cartridge. This vibration is then amplified and sent to the speakers in a vicious circle that can even produce hum and howl at various frequencies.

Denon's DP-100M turntable is said to solve the problem of acoustic feedback using an intricate system of both spring and oil damping to virtually eliminate ground and air-propagated acoustic feedback. The 'Dynamic Servo Tracer' tonearm also has an elaborate damping system which includes a lamination-damped cartridge shell. The resonance cut-off point has been engineered as low as possible.

For rotational stability, the

DP-100M features a high torque, three-phase ac servo motor coupled with a quartz crystal oscillator. A magnetic pulse sensing system on the inside rim of the dual construction platter constantly monitors the speed during operation.

Weighing nearly 50 kg, the Denon DP-100M is available only by special order. Contact Denon for more details.

B&W monitors for Polygram

The entire group of Polygram recording companies has decided to adopt exclusively the B&W Model 801 speakers as their classical music monitors.

Probably the largest recording group in the world, Polygram includes the labels of DGG, Archiv, Philips and Decca. This means that the B&W 801 will be used exclusively for all the world's major digital and analogue classical recordings, according to John Bowers of B&W.



Budget cassette deck from Pioneer

As a part of their new 'Avante Silver Component' range, Pioneer Electronics have released three new cassette decks. All of them are loaded with the latest technology, and are priced to suit all budgets.

The CT-320 is an elegantly styled slimline deck with a host of features, including the latest music search system. To operate this function all you do is touch the Play button and either the Fast Forward or Rewind control, depending on which direction the track you want is. The tape travels until it comes to the first unrecorded section of tape the machine senses; it then automatically changes into the Play mode and you hear the track you want.

Other features on the CT-320 include Dolby 'B' noise reduction to give increased signal-to-noise ratio. The CT-320 has the latest in LED

displays to enable the most accurate possible recording level adjustment, and soft touch controls for easy operation.

The specially designed, electronically controlled dc servo motor ensures that performance of the CT-320 is the best possible for the price. Wow and flutter are 0.05%, which means excellent reproduction of sound, aided by a signal-to-noise ratio of 68 dB with Dolby 'B' on.

The Pioneer CT-320 cassette deck retails at \$189. For further information contact Robin MacDonald on (03)580-9911; telex: 33482.

Sophisticated Toshiba mini stereo

Produced for the growing headphone stereo market, the Toshiba Model KT-R2 stereo cassette recorder is claimed to be an outstanding achievement in miniaturisation, combined with remarkable fidelity.

The lightweight, compact unit features an inbuilt microphone for stereo recording, plus sophisticated tape facilities including a selector for normal, chrome and metal tapes, and a music quick-transfer system.

A separate Toshiba cassette-type FM tuner pack (98-108 MHz) is provided.

Convenient facilities include four LED indicators, a stereo/mono selector, and two pairs of headphone jacks.

Despite its compact size, the Toshiba KT-R2 delivers an output of 40 mW + 40 mW.

Other recent introductions by Toshiba in the mini stereo market include the KT-S1 cassette player and the RP-700FH stereo portable radio.

For enquiries or additional information concerning these products, contact Roger Porter on (02)922-6877.



Single-tube camera has 450 lines

Hitachi's new FP10 lightweight colour camera uses a single tri-electrode saticon tube to obtain horizontal resolution of 450 lines, normally only possible in cameras with three tubes. Signal-to-noise is said to be in excess of 48 dB (PAL).

The single tube of course reduces the cost of the colour camera, and the FP10 is said to be easy to operate, with features such as auto iris, automatic beam optimiser, auto white and black balance, and +6 dB/+12 dB high gain for operation under low light level conditions.

Standard lens for the FP10 is a 10x1 power zoom, which can be easily adapted to rear control to pro-

vide studio facilities when used in conjunction with the optional remote operational unit and 4½" viewfinder.

Hitachi's local agents, AWA Redifusion Pty Ltd, are hopeful of making the first delivery of the FP10 during March this year. For further information contact AWA Redifusion Pty Ltd, 376 Eastern Valley Way, Roseville NSW 2069. (02)406-5677.

REACH FOR RALMAR...

DECISION DIRECTORY

V

- Volume controls
- Video Connecting Cable
- Video Head Cleaners
- Video Tape Splicers

W

- Wall Sockets
- Wire & cable
- Wire strippers
- Wireless microphones
- Windshields
- Woofers

Z

- Zero freeze

PUMP AND SPRAY RECORD CLEANER

SRC-2

Proven formula in pump action atomiser.

Removes grit and dust deposits from your records.

Leaves no film deposits.

Just polish off with soft cloth.

Large 125ml bottle.



**JUST PART OF THE RANGE!
AVAILABLE AT SELECTED
STORES EVERYWHERE!**

TRADE ENQUIRIES...

N.S.W. Ralmar Agencies P/Ltd (02) 439 6566

Vic. Ralmar Agencies P/Ltd (03) 267 3028

S.A. Charles Harwood P/Ltd (07) 264 1118

QLD. Olbertz International P/Ltd (07) 261 1513

W.A. Bruce Ingram & Assoc. P/Ltd (09) 381 7777

TAS. George Harvey P/Ltd (003) 331 6533

RALMAR®

RAL2/81

PEERLESS SPEAKERS

The name behind the big names in hi-fi!

Chosen for their high quality by the world's leading speaker makers!

Peerless is a world authority on loudspeaker design. In fact, many of the world's top hi-fi manufacturers select Peerless speaker components for inclusion in their own Brand Speaker Systems. Made in Denmark, Peerless speakers are incomparable for their high-power handling, smooth frequency response, low distortion and colouration.

Peerless speakers can be purchased three ways:—

1. Fully-assembled in timber cabinets — from bookshelf to floor-standing models.
2. Speaker Kits — build-it-yourself and save up to 40% on assembled speaker prices.
3. Individual speaker components to suit your exact hi-fi needs.

Peerless makes speakers to suit amplifiers from 20-100 watts. For true-to-life sound, Peerless is the name behind the biggest names in hi-fi. Hear Peerless speakers at one of the authorised dealers below — or contact the sole importer for full technical details.

Sole Australian Importer: G.R.D. GROUP PTY. LTD.
698 Burke Road, Camberwell, Vic. 3124. Trade Enquiries welcome.



Peerless

N.S.W.

Bondi Junction

Danish Hi-Fi (Aust.) Pty. Ltd. Ph: (02) 387 5878

Concord

Electronic Agencies Ph: (02) 745 3077

Crows Nest

Deeva Hi-Fi Ph: (02) 439 3999

Dee Why

David Ryall Electronics Ph: (02) 982 7500

Wagga Wagga

Car Radio & Hi-Fi Centre Ph: (069) 21 4618

VIC.

Ballarat

Turner Audio Ph: (053) 32 2042

Camberwell

Danish Hi-Fi (Aust.) Pty. Ltd. Ph: (03) 82 7348

Cheltenham

Beland Electronics Ph: (03) 550 2279

Geelong

Steve Bennett Audio Ph: (052) 21 6011

Hawthorn

Tivoli Hi-Fi Ph: (03) 818 8637

Warrnambool

Bruce Henderson Audio World Ph: (055) 62 5147

S.A.

Adelaide

Hi-Fi Acoustics Ph: (08) 223 6774

Adelaide

Danish Hi-Fi (Aust.) Pty. Ltd. Ph: (08) 51 2124

Goodwood

The Acoustic Foundry Ph: (08) 271 0276

Hawthorn

Sound Craftsmen Ph: (08) 272 0341

St. Peters

Miltronix Ph: (08) 42 3781

W.A.

Claremont

Danish Hi-Fi (Aust.) Pty. Ltd. Ph: (09) 384 2852

Kalamunda

Beale Charter Pty. Ltd. Ph: (09) 293 1512

QLD.

Brisbane

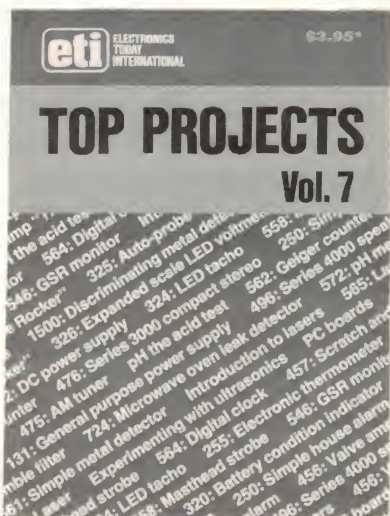
Brisbane Agencies Ph: (07) 221 9944

Audio Centre

Redcliff Ph: (07) 284 2495

Hi-Fi Sales

CONCORD/PS792



HERE IT IS!

Over 20 of our top-popularity projects from recent years' ETIs plus several projects from a few years back that have enjoyed renewed interest. All assembled in one big volume — there's something to suit every electronics enthusiast's interest, from the ETI-250 Simple House Alarm to the ETI-1500 Discriminating Metal Detector, from the ETI-325 Auto-probe to the ETI-562 Geiger Counter, from the ETI-724 Microwave Oven Leak Detector to the ETI-565 Laser. TWENTY projects, in all — PLUS: 'An Introduction to Lasers', 'pH — the Acid Test' and 'Experimenting With Ultrasonics'. Top Projects Vol. 7 also contains a Shoparound guide on where to obtain pc boards, front panels, kits and components for the projects between its covers.

ON SALE NOW AT NEWSAGENTS AND SELECTED ELECTRONICS SUPPLIERS. Or you can obtain a copy direct from ETI for \$3.95 plus 65 cents post and handling. Send your cheque or money order to ETI Magazine, 15 Boundary St, Rushcutters Bay NSW 2011. Ask for: 'Top Projects Vol. 7.'

Gale loudspeakers

Now you can afford to have
the best-for less . . .

The remarkable British made Gale loudspeakers have earned a reputation for outstanding craftsmanship and performance.

The GS-410A in striking black and chrome finish or the GS-401C concave design in conventional American walnut both offer exceptional value for money.

Gale performance is outstanding by even the most critical standards. Hi-Fi studio magazine said; "This loudspeaker is certainly among the five best loudspeakers available"

Australian Hi-Fi magazine — "The Gale GS-401A is one of the finest sounding dynamic loudspeakers that we have heard" And, "This is not a cheap speaker — until you look at it on a price/performance basis. Then it starts to look like a bargain".

Now Arena Distributors have just received a new shipment of Gales at a reduced price. Together with an unparalleled 7 year warranty, these fine loudspeakers represent excellent value for money — so buy now and have the best for less.



Gale

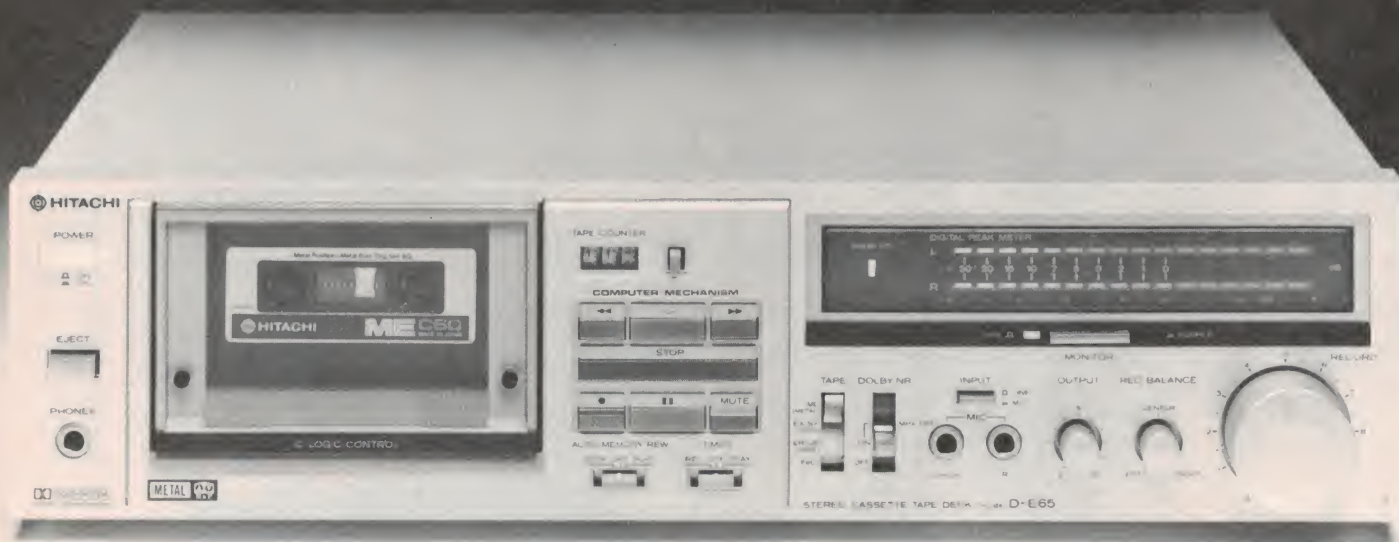
Available at leading hi-fi retailers
Sole Australian agents

arena
DISTRIBUTORS

Australasia Pty. Limited

1st Floor, 642 Albany Highway, Victoria Park, Western Australia 6100. Postal address: P.O. Box 178, East Victoria Park, Western Australia 6101.
Telephone 361 5422 Telex/Arena 93299

Send to: Arena Distributors, P.O. Box 178, East Vic. Pk, W.A. 6101.
Please send me more information
on Gale GS401A ☐ GS401C ☐
Name: _____
Address: _____
State: _____
Postcode: _____



Modern tape recorder technology

Part 1

Reel-to-reel and cassette tape recorders released over the last few years feature electronic and mechanical facilities that offer the user incredible performance and versatility. The article covers the technology and techniques employed in modern analogue tape recorders, illustrated with partial circuits and mechanical diagrams.

Brian Dance

THE FIRST tape recorder to be marketed was the open-reel type (also known as the reel-to-reel), but cassette recorders are now more popular for domestic use. Cassette recorders have the advantage of convenience, since it is much easier to insert the cassette than to thread a tape in a reel-to-reel recorder. The performance of the early cassette recorders with relatively narrow, slowly moving tapes was very poor, but this performance has greatly increased with improvements in tape heads, the use of chromium dioxide (CrO_2) and now metal particle tapes, etc.

Nevertheless, all professional tape recorders are still of the open-reel type. This type of recorder is more expensive than a similar cassette recorder, but provides better reproduction than many cassette machines, longer playing time, and a much wider range of facilities. An open-reel recorder normally offers a choice of tape speeds, the high frequency

response improving with increasing tape speed. A modern open-reel recorder may provide a response level to within ± 3 dB to beyond 20 kHz at a tape speed of 19 cm/sec and a response to about 18 kHz at half this speed, with the advantage of twice the playing time. In addition, open-reel recorders enable tape editing to be performed, while master recordings can be made with a multi-track system carrying any required information on one or more of the other tracks.

Cassette decks normally operate at the single speed of 4.75 cm/sec, but there are a few recorders (such as the Teac C-3X) which can also operate at twice this speed for optimum performance.

Frequency specifications of high-quality decks vary with the tape employed; for example, Optonica quote the following upper values for their RT-

7070H deck, all for ± 3 dB variation: (i) normal tape 16 kHz (ii) CrO_2 tape 18 kHz (iii) ferrichrome tape 19 kHz (iv) metal tape 20 kHz.

Apart from frequency response, the other parameters of open-reel recorders tend to be better than those of cassette types. For example, the wider tape used in the open-reel types helps to produce a better signal-to-noise ratio; in theory the double tape width normally used increases this ratio by a factor of $\sqrt{2}$, but in practice the improvement is usually greater than this. Open-reel decks usually provide less distortion, better stereo channel separation, less wow and flutter, etc.

The continuous playing time of a cassette tape is limited by the standard size of the cassette and by the impossibility of making a very thin tape adequately strong.

Sections of a deck

All recorders must employ a *tape transport* mechanism. The early recorders used a motor, sometimes synchronised to the mains, to drive a large fly-wheel which was coupled to the tape by means of a capstan wheel and a rubber pinch-wheel system. In some decks the same motor is used to drive the tape reels, whereas other decks use separate motors for this purpose. Thus there may be one, two or three motors in a deck. Brushless dc motors are now often used in high-quality recorders, since they generate minimum noise. In such motors a semiconductor circuit replaces the conventional carbon brush and commutator system for controlling the direction of current flow in each winding. Servo circuits (some incorporating a phase-locked loop) may be employed for accurate speed control.

The magnetic tape moves across the face of an erase head and normally at least one other head. This may be a record/replay head or separate heads may be employed for recording and replaying, depending on the class of recorder. The correct currents must be applied to the heads according to the mode of operation at the time, and many recorders employ complex logic systems for the control and switching of these currents.

The signal from a replay head is at a very low level and must be greatly amplified. In addition, frequency 'equalisation' circuits must be incorporated into

both the recording and replay amplifiers so that the overall amplification of the complete record/replay system is flat across the audio range. Some form of noise reduction circuitry is almost essential for good reproduction from cassette recorders and is desirable for optimum results in open-reel equipment.

An oscillator operating at about 100 kHz is required for erasing and for providing the recording head with the bias required for low distortion.

Additional circuitry is needed to indicate (and perhaps to automatically adjust) the level of the signal being recorded so that the tape is neither overloaded (which would produce distortion) nor under-recorded (which would raise the noise level). Further circuitry is required on some recorders for adjusting the equipment for the particular type of tape employed. Thus it is not surprising that tape recorder circuitry is complex and that manufacturers are introducing microprocessor control in some models. The provision of such facilities as remote control adds further to the circuit complexity.

Erase heads

Erase heads must efficiently erase any signals previously recorded onto the tape; they normally have a slightly wider track than the recorded tracks so as to ensure that the whole width of the recorded signal is erased. A relatively wide gap of some 100 μm to 1 mm is employed in the ferrite core so that the

field is adequate.

The advent of high coercivity tapes, especially metal tapes, has rendered erasure more difficult, so some manufacturers use a two-gap erase head of the form shown in Figure 1. The tape

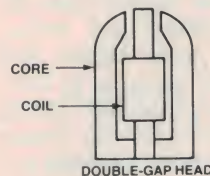
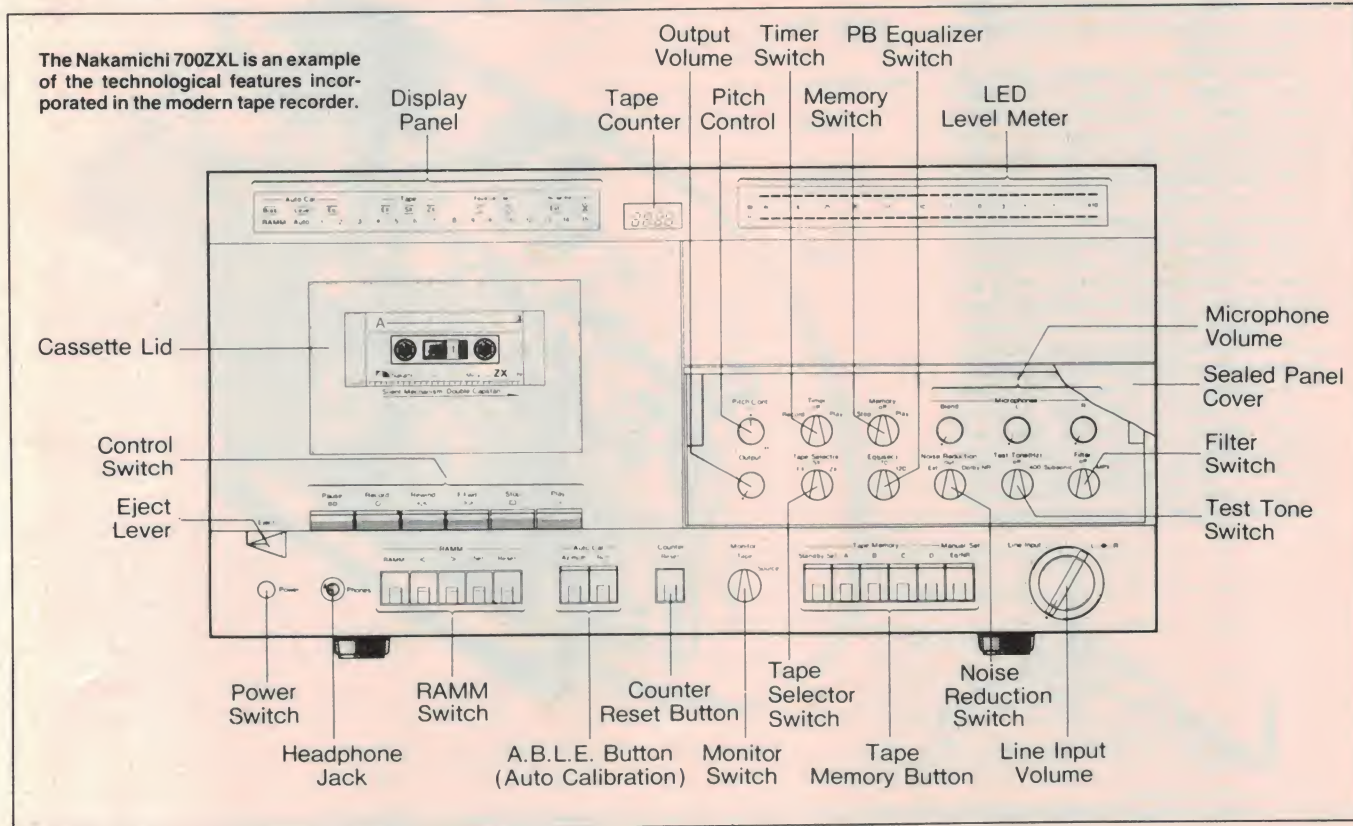


Figure 1. A double-gap erase head (Teac).

first passes across the one gap, which takes the material of the tape through several hysteresis cycles and greatly attenuates the recorded signal. The tape then passes over the second gap, which completes the erasure process. JVC employ erase heads with two gaps and claim that an improvement of some 10 dB is obtained in the signal-to-noise ratio in the case of a tape containing a 400 Hz note by the use of a dual gap head.

Record and replay heads

A head designed purely for recording purposes usually has a gap width of between three and 30 μm . However, a playback head must have a smaller gap, since this gap should be appreciably smaller than the wavelength on the tape of the highest frequency to be replayed. Gaps of less than 1 μm are often used. The head is screened in mu-metal to prevent pickup of stray mains hum fields.



Record/playback combined heads involve some compromises in their design, but are used in many cassette decks where space is limited. It is even possible to include an erase and a recording head in one unit.

Three main classes of core material are employed in record and replay heads. Permalloy (iron, nickel and molybdenum) can be employed as laminated thin sheets to reduce eddy current losses. Manganese-zinc-ferrite heads are more resistant to wear and need not be laminated, as the resistivity of the material is much higher. Many manufacturers now favour the use of a material known as 'Sen-alloy' because of its

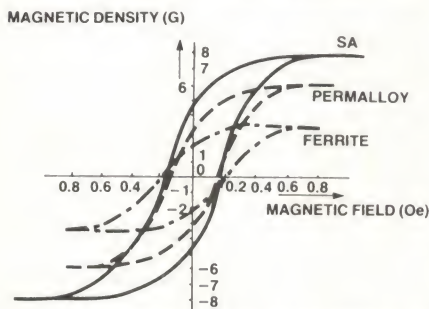


Figure 2. Hysteresis loops of various tapes showing the high saturation density of JVC's SA type.

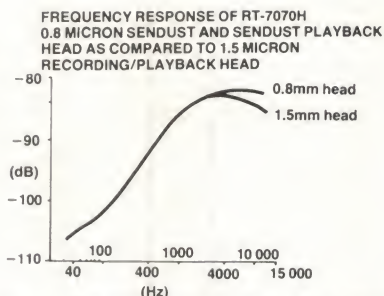


Figure 3. Frequency response of a 0.8 um-gap head compared with a 1.5 micron gap head (Optonica).

relatively high saturation permeability (see Figure 2), which facilitates the production of a relatively high field in the head gap for recording with high coercivity tape.

Sen-alloy has been known for well over 40 years, but its original form proved almost impossible to machine owing to its extreme brittleness. However, this problem has now been overcome and 'Sendust' heads are used in cassette decks by Pioneer, Optonica, etc. Accurate machining is especially important for the playback head, where the gap may be less than 1 um. The Pioneer RT-7070H cassette deck employs a recording head with a 3 um gap

and a playback head with a 0.8 um gap; the response of a system with this playback head and with a 1.5 um head used for both recording and playback is shown in Figure 3.

An important factor in the choice of head material is the rate of wear, which is typically of the order of 1 um or more per thousand hours of use, depending on the tape speed. When a head undergoes wear, the gap increases, as shown in Figure 4, and this will impair the frequency response of a replay head. JVC employ six permalloy laminations in their SA heads, with a heat-bonded Sen-alloy gap/guard which has the hardness of ferrite and is therefore very wear-resistant. Permalloy itself has poor

To page 121 ►

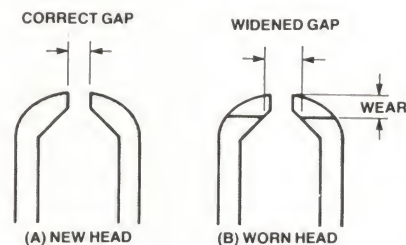


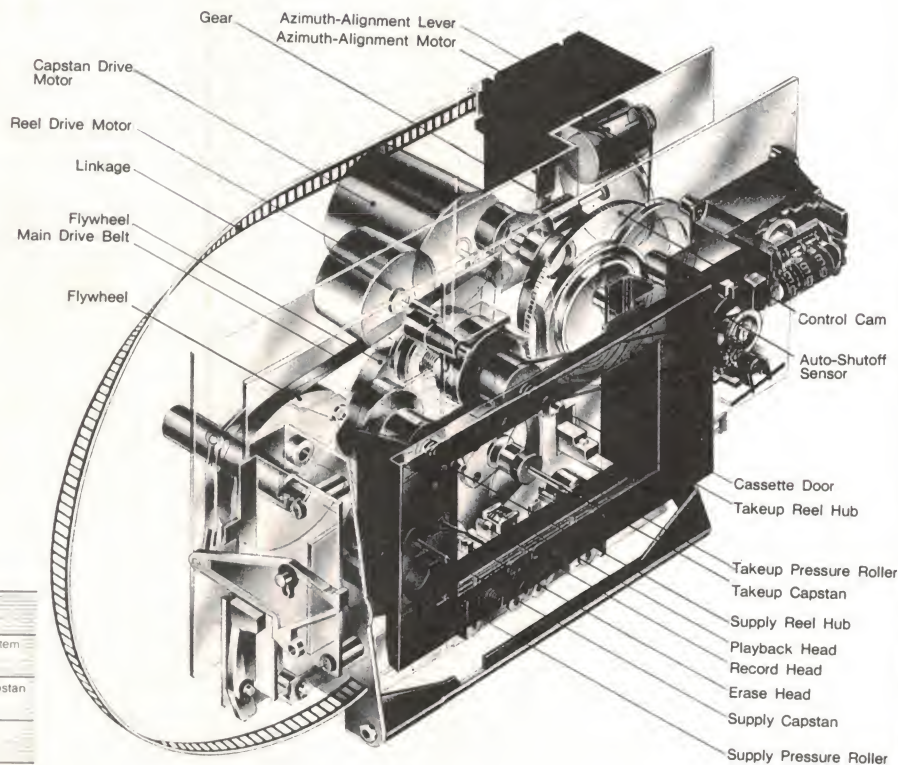
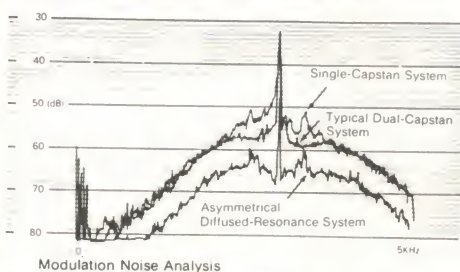
Figure 4. Effect of head wear on gap width (Teac).

'DIFFUSED RESONANCE' CASSETTE TRANSPORT

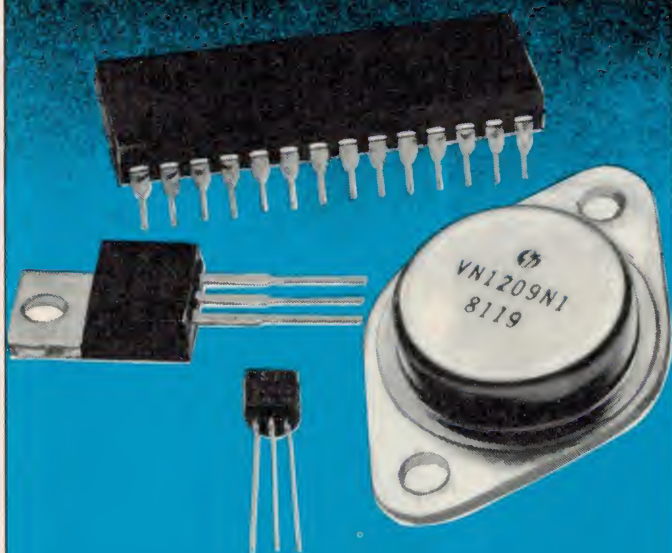
Developed and manufactured by Nakamichi, and introduced barely three years ago, the 'asymmetrical, diffused resonance, double capstan transport' is claimed to reduce significantly the problems of wow and flutter and modulation noise.

Double capstan transports isolate the 'active' portion of the tape from reel-hub perturbations, but there are mutual resonances that occur that contribute to audible tape flutter, according to Nakamichi, much more than specifications suggest. To overcome this problem, Nakamichi designed transports with capstans and flywheels that rotate at different rates, eliminating common-mode resonances. Also, another source of flutter and modulation noise comes from tape vibration as it passes the magnetic heads. This partially originates with motor vibration, so the Nakamichi transport has an aluminium chassis coated with vibration-damping resin.

No pressure pad to ensure tape-to-head contact is used, as Nakamichi have paid special attention to controlling take-up and holdback tension. A tape-pad lifter is incorporated in the mechanism so that the pressure pad does not rub on the tape and contribute to the flutter and modulation noise.



SUPERTEX VMOS POWER FETS



P&N CHANNEL 10mA-50A 20v-800v

- HIGH SWITCHING SPEED. (NO STORAGE TIME DELAY).
- DIRECTLY INTERFACES TO CMOS, TTL AND MOS.
- HIGH GAIN.
- LOW DRIVE CURRENT.
- FREE FROM SECONDARY BREAKDOWN AND VOLTAGE DERATING.
- DRIVES INDUCTIVE LOADS.
- AVAILABLE IN T03, T0220, T039, T092 AND D.I.L. PACKAGES.

Technical information available on request.

SOANAR

Soanar Electronics Pty Ltd

A member of the A & R Soanar Electronics Group
30 Lexton Road, Box Hill, Vic., 3128. Australia

VICTORIA: 840 1222 QUEENSLAND: 52 1131
N.S.W. 789 6733 WEST. AUST. 381 9522
Sth. AUST. 42 8918 TASMANIA: 31 6533

REACH FOR RALMAR...

WHEN IS A MIC NOT
ONLY A
MIC?



WHEN IT IS ALSO A

- 7.5 watt P.A. amplifier with volume control.
- Built-in siren.
- LED indicator.

Simple connection to a horn speaker and 12 volt (neg) supply is all that is required. (Horn speaker is extra). Ideal for sporting events, crowd control, emergency services and mobile electioneering. The possibilities are up to you.

DECIBEL METER



HOW LOUD
IS THAT
HI FI?

HOW NOISY
IS THAT
TRAIL BIKE?

This handy dB meter will give you the necessary information. Covers 40 - 110dB in six steps. Easy read dial covers ± 10 dB. Sensitive electret microphone. Battery check. Ear phone listening if required. Ideal in fact for anyone who has to measure noise levels or sound pressure, dynamid range, insulation levels, frequency characteristics or general environmental noises.

TRADE ENQUIRIES...

N.S.W. Ralmar Agencies P/Ltd (02) 439 6566
Vic. Ralmar Agencies P/Ltd (03) 267 3028
S.A. Charles Harwood P/Ltd (07) 264 1118
QLD. Olbertz International P/Ltd (07) 261 1513
W.A. Bruce Ingram & Assoc. P/Ltd (09) 381 7777
TAS. George Harvey P/Ltd (003) 331 6533



RALMAR®

IT NOT ONLY SOUNDS FAMILIAR, IT SOUNDS FANTASTIC.

If you were interested in hi-fi a few years ago, you'll remember the name Fisher.

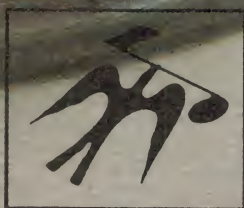
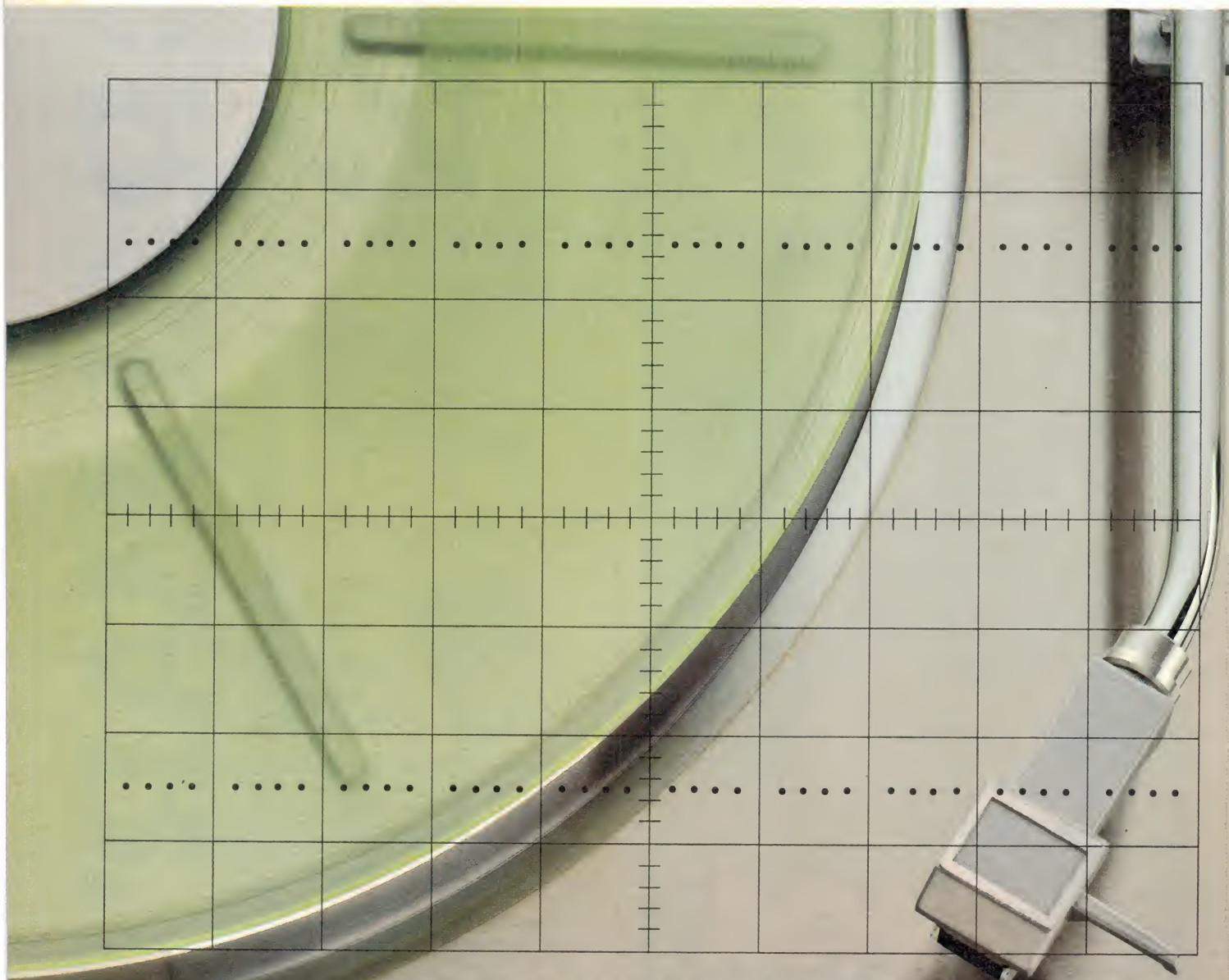
Fisher made the first dynamic range expander back in 1939.

The first transistorised preamplifier/equalizer in 1956. Fisher also introduced the

first stereophonic AM/FM receiver in 1959.

But if you have not heard what we've been up to lately, we suggest you get along to a Fisher retailer. At your retailer you'll find some products that not only sound familiar.

They sound fantastic. **The first name in hi-fidelity.**



FISHER

Marantz Gold. Your New Recording Standard.



For over twentyfive years the name Marantz has stood for the ultimate in audio engineering brilliance and fidelity.

In keeping with this standard of technical excellence, the new Marantz Gold range of Cassette Decks with stunning designer element of brushed-gold finish now includes a recorder incorporating the latest in noise reduction processing.

The Marantz SD3030 Cassette Deck features the new Dolby C system to provide recordings with far less tape hiss than those made using standard Dolby B.



Unlike some other noise reduction systems, Dolby C recordings can be played back on a deck equipped with standard Dolby only without audible distortion or pumping effects.

Recording enthusiasts will be delighted by the other models in the new range.

Marantz Gold decks offer a variety of advanced features such as LED peak level meters on the SD1030, fine bias adjustment on the SD2030, and a motorized linear skating loading system on the SD5010.

Decks shown in stack (from top): SD1030, SD3510, SD2030, SD3030 and SD5010. All decks shown with TDK Metal tapes.

Dolby and Dolby Systems are trademarks of Dolby Laboratories, Inc.

Copyright may exist on material you wish to record. Copying on such material requires the permission of the owner or owners.

Distributed by MARANTZ (Australia) Pty. Ltd. 19 Chard Road, Brookvale NSW 2100
Telephone (02) 939 1900 Telex AA24121 Melbourne (03) 544 2011,
Brisbane (07) 44 6477, Adelaide (08) 223 2699, Perth (09) 276 3706, Townsville (077) 72 2011

All feature Dolby B noise reduction, compatibility with metal tapes, soft touch controls and DC Servo motors to ensure constant tape speed and silent operation.

So, set your standards high. And your recording standards higher.

See your local stockist and listen to the future. Listen to Marantz.

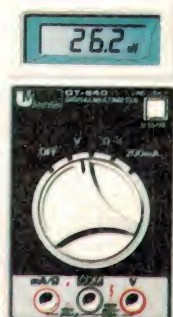
marantz®
Now you're listening.



Marantz Gold.
The New Audio Standard.



Real measuring power in the palm of your hand



The DT830 from Univolt sets new standards for ruggedness, precision and measuring power. The large, clear function selector shows the 830's 30 measuring ranges at a glance. The high contrast 3.5 digit LCD display gives quick, unambiguous readings. Accuracy is an excellent $\pm 0.5\%$ and resolution 0.1mV on the bottom DC scale. 10 amp current range and transistor tester are built in, along with an audible continuity test function for quick circuit checks. The DT830 – your complete measuring instrument.

For less demanding applications, the Univolt DT840 gives quick auto ranging and $\pm 0.8\%$ accuracy. Speedy servicing with 20 ranges and built in continuity checker.

For the name of your nearest dealer and trade enquiries contact:

I.F.T.A. Australia
A division of BENELEC Pty Ltd.



1 Greville Street,
Randwick 2031
Ph: (02) 665 8211
Telex: AA20181

Try out the UniVolt multimeter range at these distributors

Sydney Metropolitan

● Sheridan Electronics
164-166 Redfern Street,
Redfern. Phone (02) 699 5922

● Electronic Agencies
117 Parramatta Road Concord
Phone (02) 745 3077

123 York Street, Sydney
Phone (02) 29 2098

● J.P.&A Electronics
84 Ramsay Street, Haberfield
Phone (02) 799 3331

Newcastle and Northern NSW

● Galaxy Sounds
79 Maitland Road Islington
Phone (049) 61 1100
355 High Street, Maitland
Phone (049) 33 5510

● Rural Drive Audio
& Electrical
35 Rural Drive, Sandgate
Phone (049) 67 3022

Queensland

● General Wholesalers
Pty Limited

57 Jones Street, Fortitude
Valley. Phone (07) 358 4122

● Santina Electronics
60 Glenmore Road,
North Rockhampton.
Phone (079) 27 1808

Victoria

● J.H. Magrath
208 Little Lonsdale Street,
Melbourne.
Phone (03) 663 3731

● John Pearce
14 Tantram Avenue, St Kilda
Phone (03) 528 5240

South Australia

● Electronic Components
and Equipment
64 Sturt Street, Adelaide
Phone (08) 212 5999

Western Australia

● Everett International
Pty Limited
17 Northwood Street,
Leederville.
Phone (09) 381 5500

Northern Territory

● Cooper & Davis
18 Knuckley Street, Darwin
Phone (089) 81 3423



Glover & Assoc. IFTA/5A1

From page 116



Technics top-line RS-M270X cassette deck features both Dolby and dbx noise reduction systems.

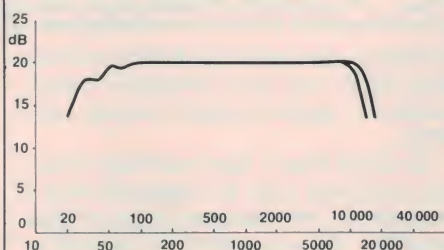


Figure 5. Frequency response of JVC SA head with iron oxide and with chrome tape. Chrome tape has extended frequency response.

wear resistance. Figure 5 shows the frequency response of a JVC SA head for a normal iron oxide tape and for a chrome tape, while Figure 6 shows the same characteristics after 3000 hours' use.

Equalisation

Let us imagine a tape has been recorded at various frequencies with the amplitude of the current passing through the recording head kept constant and inde-

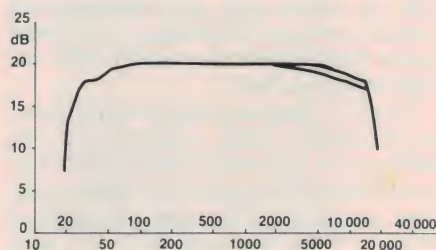
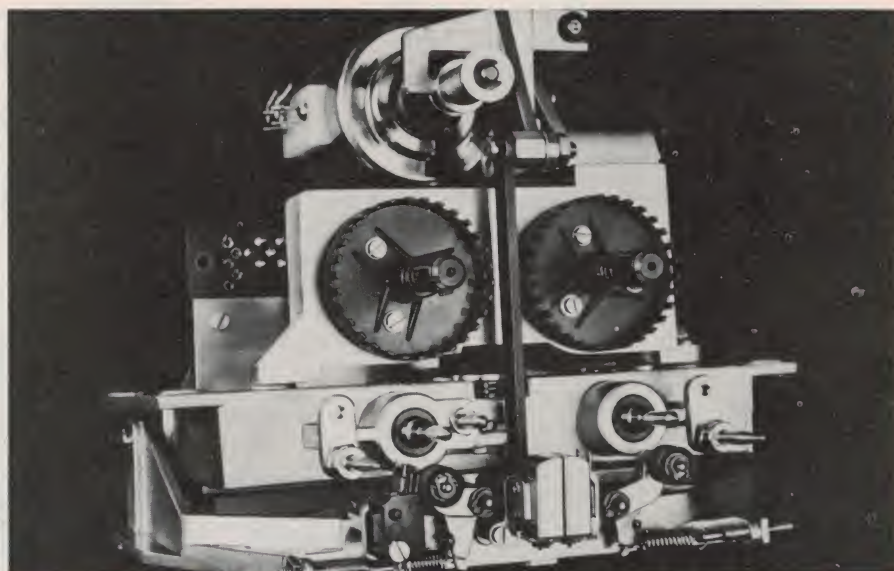


Figure 6. Frequency response of the same head with the same tape types after 3000 hours' use. Note that the frequency response with ordinary oxide tape commences rolling off in the 2 kHz region.

pendent of the frequency. When the tape is replayed, the magnetic flux in the replay head will vary at a rate proportional to the frequency. The signal voltage produced by the head is proportional to the rate of change of the magnetic flux and can therefore be expected to be proportional to frequency; that is, the amplitude of the signal from the head rises at 6 dB/octave.



The interior mechanical mechanism of the Revox B710 microprocessor-controlled cassette deck. A four-motor drive is employed with electronic rather than mechanical brakes. Motor speed is controlled by two PLL circuits.

At low frequencies this rise is indeed found, but at the higher frequencies a smaller rise is observed until at very high frequencies the response falls off with increasing frequency. This is due to increasing losses at higher and higher frequencies in both the recording and replay process; this is admirably demonstrated by the curves of Figure 7. During recording the losses include some demagnetisation as the tape magnetised by the signal is slightly demagnetised by later parts of the signal; a self-demagnetisation loss due to the effect of nearby parts of the magnetised tape; a thickness loss arising from the fact that the whole thickness of the tape coating cannot be in contact with the head gap; a separation loss due to imperfect contact between the tape and the head gap; and eddy-current losses in the core of the head. All of these losses tend to become greater with increasing frequency.

Similar frequency-dependent losses on playback include a gap loss if the head gap is not much smaller than the wavelength of the signal recorded on the tape; a separation loss due to imperfect contact of the head gap with the tape (this is a much larger effect than separation loss on recording, since even a separation of some microns due to dirt, etc. can greatly reduce the head terminal voltage); a tape thickness loss arising from the fact that only the top surface of the magnetised coating can be in contact with the head gap; an azimuth loss if the head gap is not perpendicular to the direction of travel of the tape; and an eddy-current loss in the material of the replay head core. These losses again all increase with frequency, as indicated in Figure 7.

The frequency response will also fall at very low frequencies where the wavelength of the recorded signal is comparable in size with the dimensions of the complete playback head.

In order to obtain an overall frequency response which is level over the required audio bandwidth, it is obviously essential to employ recording and replay amplifiers in which the frequency response of these amplifiers is suitably tailored to achieve the desired 'flat' overall characteristic. This frequency compensating process is known as 'equalisation'.

Much of the high frequency equalisation normally takes place during recording, since this results in the high frequency signals being recorded at a higher level on tape, with the result that a better signal-to-noise ratio is obtained on playback. Tape noise is most prominent at high frequencies in the form of a 'hiss'.

The equalisation required varies

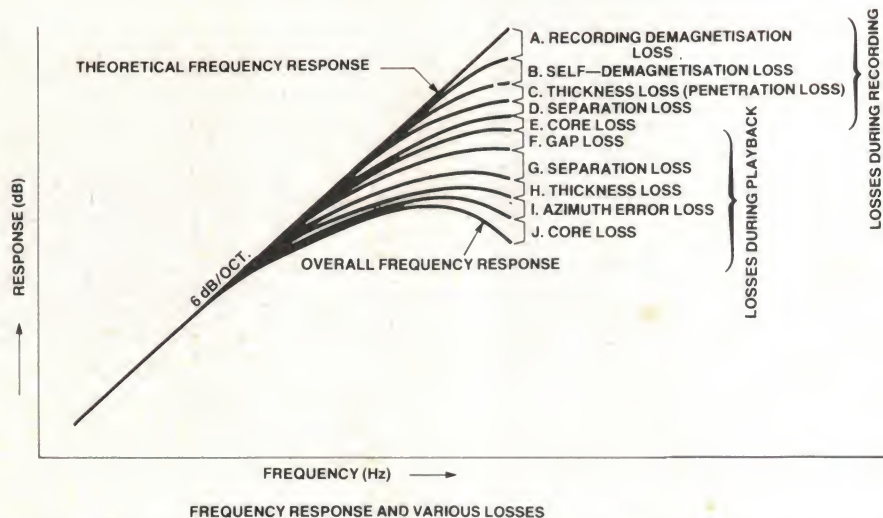


Figure 7. The expected 6 dB/octave rise in recording and playback frequency response occurs over the lower frequencies, but this rolls off considerably at the higher frequencies due to various losses.

with the tape speed, the heads used, the bias level, etc. Low frequency equalisation is applied mainly during playback.

In order that a tape recorded on any one machine may be replayed with a reasonably level response on any other machine, some standard is required for the equalisation system for each tape speed. As an example, the NAB (National Association of Broadcasters) playback equalisation standard for 19 cm/s tape speed is shown in Figure 8. It may be noted that the centre part of the curve is straight, with the 6 dB/octave fall which compensates for the rise in Figure 7. However, the response at the lower and upper parts of the curve is tailored by means of RC time constants of 3180 μ s and 50 μ s respectively. This same standard is also specified for 38 cm/s, whereas at 9.5 and 4.75 cm/s the time constants are 3180 μ s and 90 μ s to produce treble lift at lower frequencies. Somewhat similar standards have been

adopted in Europe and Japan.

The standard replay characteristic is for an ideal head system, but the limitations of practical heads are compensated in the playback amplifier. Hence the characteristic of a practical amplifier is modified at high frequencies, as shown by the dashed line of Figure 8.

In practice, a tape designed in accordance with the appropriate standard is played back and the playback equalisation circuit is adjusted until a flat response is obtained at the output of the circuit. A tape is then recorded and the recording equalisation circuit is adjusted until a flat response is obtained when the tape is replayed.

It should be noted that no recording frequency characteristic is specified as a standard, since tape and head performance can vary considerably. Any type of recording equalisation characteristic can be employed, provided that a level overall response can be obtained when used with a standard playback system. ●

(— to be continued)

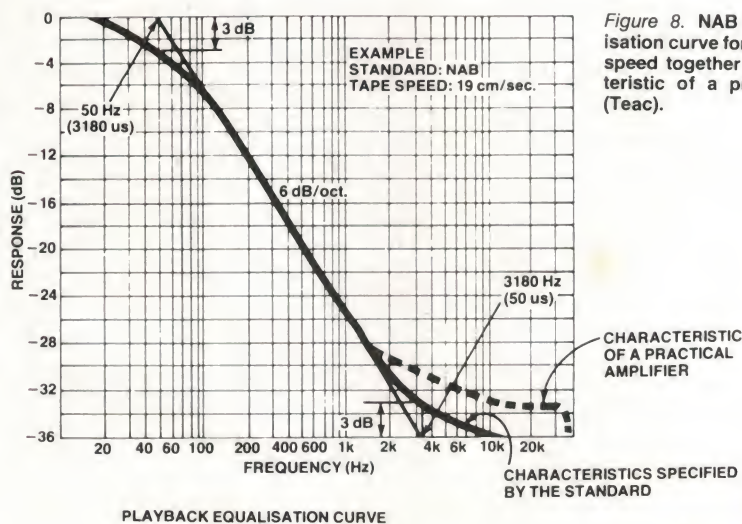


Figure 8. NAB playback equalisation curve for a 19.5 cm/s tape speed together with the characteristic of a practical amplifier (Teac).

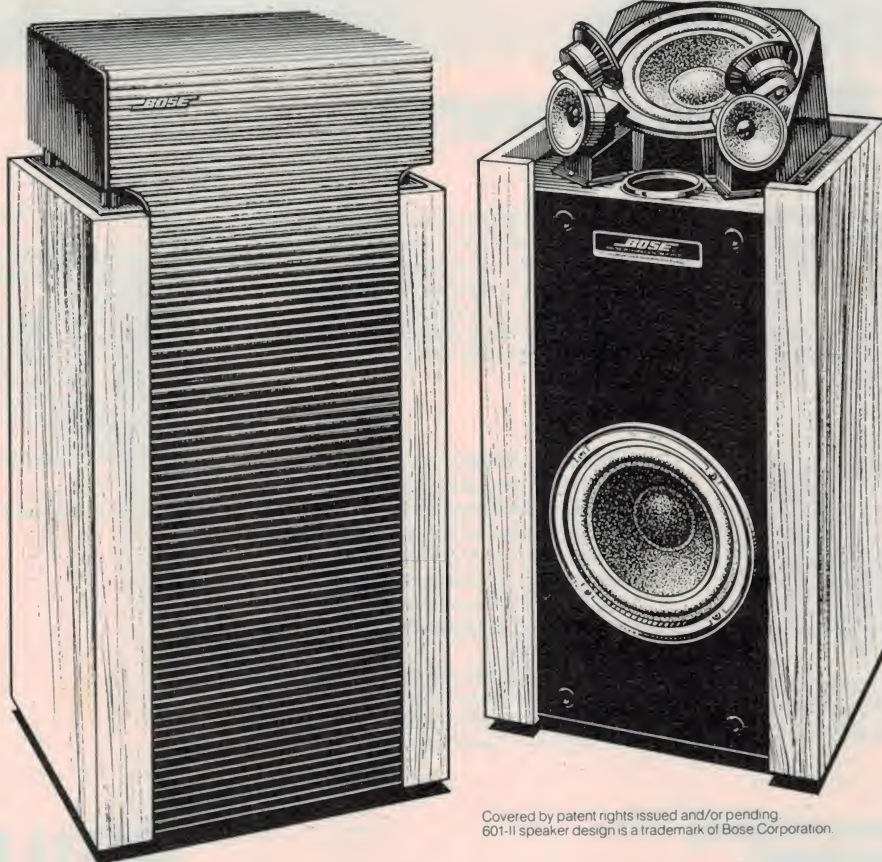
BOSE® introduces the new Bose® 601™ Series II Loudspeaker.

Bose has long been famous for the accurate, lifelike sound of their Direct/Reflecting® speakers. Now Bose has done it again!

The new Bose 601 Series II Direct/Reflecting® Loudspeaker is the first and only speaker with the Free Space™ array. This revolutionary technology frees the drivers from the confines of the speaker cabinet to give you clear, spacious stereo imaging almost *anywhere* in your listening room. And the unique Support Enclosure System delivers powerful bass without a trace of "boominess."

Come in and experience the latest Direct/Reflecting® speaker from Bose. We think you'll be as excited about it as we are!

BOSE®
Better sound through research.



Covered by patent rights issued and/or pending.
601-II speaker design is a trademark of Bose Corporation.

**BOSE AUSTRALIA INC.,
11 Muriel Avenue, Rydalmere 2116, 684-1022**

START SMALL.... THINK BIG with microcomputer development tools

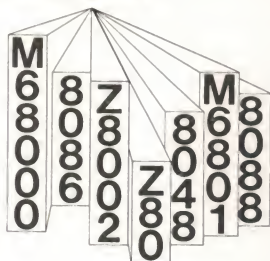


From Philips, of course

PM 4300 the Universal μ C Instructor.

To quickly learn and master microprocessor designing. To use and compare the newest microprocessors, 8 bits and 16 bits, without delay.

Personality modules are available for the 8086, 8088, Z8002, Z80, 8048 and soon for the 6801, 68000, 6809 etc.



PM 4421 the Philips μ C Development System.
To write programs in assembly language or in PASCAL. To perform efficiently the integration

of software and hardware using real-time in-circuit emulation, symbolic logic analysis, I/O simulation, multiprocessor debugging etc. Assemblers already exist or will be shortly introduced for the 68000, 6800, 6801, 6802, 6809, 8086, 8085, 8080, Z8000, Z80, 6502, 6500/1, 2650, TMS 1000, 8048 family.

PM 4300 + PM 4421 : A ready solution for the new microprocessors. It is now possible to develop source programs on the PM 4421 and to transfer the corresponding object programs in the RAM memory of the PM 4300.

Debugging can then be carried out in the user's application environment with the use of the PM 4300 emulation probe and specialized function keys.

That way a design engineer who wants to take advantage of a new microprocessor coming on the market can find support from the Philips Development Tools without costly delays.

For more detailed information phone
Philips Scientific and Industrial Equipment:

Sydney — Tom Nealon
Mike Meehan 888 8222
Melbourne — Ralph Brown 690 6366
Brisbane — Eleanor Futter 44 0191
Adelaide — Duncan Glenn 223 4022
Perth — Lois Woodcock 277 4199
NEW ZEALAND
Wellington — Steve Morris 859 859



**Test & Measuring
Instruments**

PHILIPS

□ OSCILLOSCOPES 10 - 150 MHz □ DIGITAL & ANALOGUE MULTIMETERS □ CONVERSATIONAL DATA LOGGERS □ RECORDERS CHART & X-Y □ LF & RF OSCILLATORS □ MICROWAVE EQUIPMENT
□ DC POWER SUPPLIES & AC STABILIZERS □ FREQUENCY COUNTERS & TIMERS □ TV STUDIO & TRANSMISSION INSTRUMENTATION □ PULSE GENERATORS □ AUDIO & VIDEO SERVICE EQUIPMENT

HOME JOURNAL

What's a name like that
doing in a magazine like this?

If you've got a mum,
or your wife is a mum,
then read on:

Mother's Day is
coming. And we've got
a great gift for her, from
you. Australian Home
Journal.

Every month the
Journal is full of stuff like
decorating and design

and furniture and art.

We'll send her 12
months of the Journal.
From you, for Mother's
Day.

We'll even send her
a card with your name
on it, telling her of your
present.

And all you have to
do is fill in the coupon.

From:

To:

Name:

Address:

.....Postcode:

PAID BY: Cheque/Money Order/
American Express/Bankcard

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

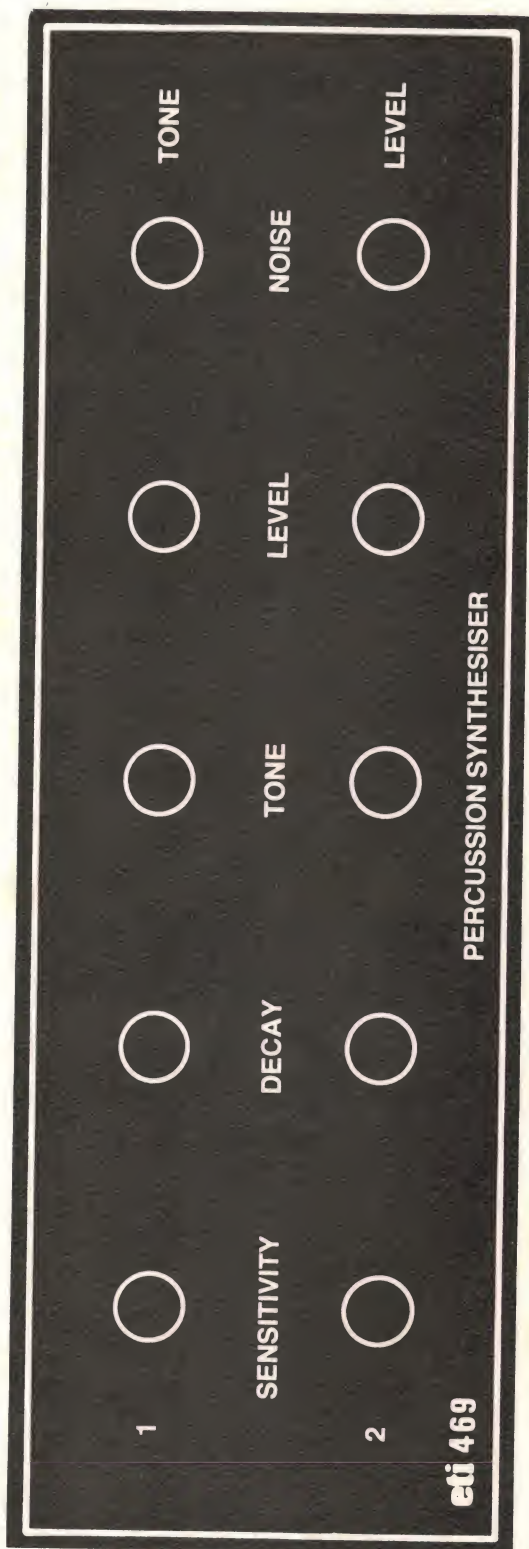
Expiry Date:

Signature:

PO BOX C102 CLARENCE ST,
SYDNEY, NSW 2000.

12 ISSUES \$18. Send 1st issue
with a Mother's Day card.

Please allow 2-3 weeks for delivery.



Using ETI PCB Artwork

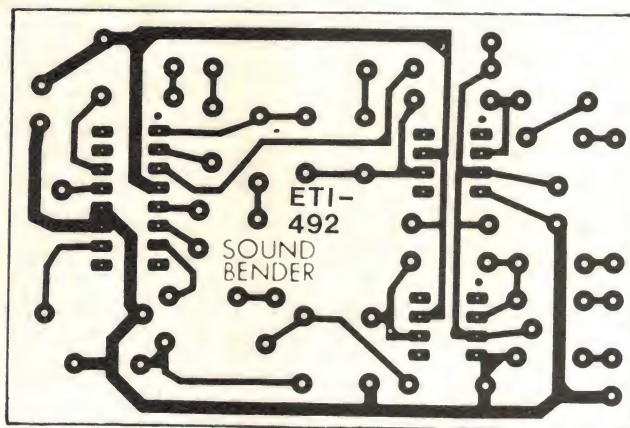
This method can be used to make negatives of ETI artwork from October 1977 on, provided the reverse of the page is printed in blue. The film used is Scotchcal 8007, which is UV sensitive and can be used under normal subdued light.

Cut a piece of film a little larger than the pc board and expose it to UV light through the magazine page. The non-emulsion side should be in contact with the page. This surface can be detected by picking the film up by one corner — it will curl towards the emulsion side. Exposures of about 20 minutes are normally necessary.

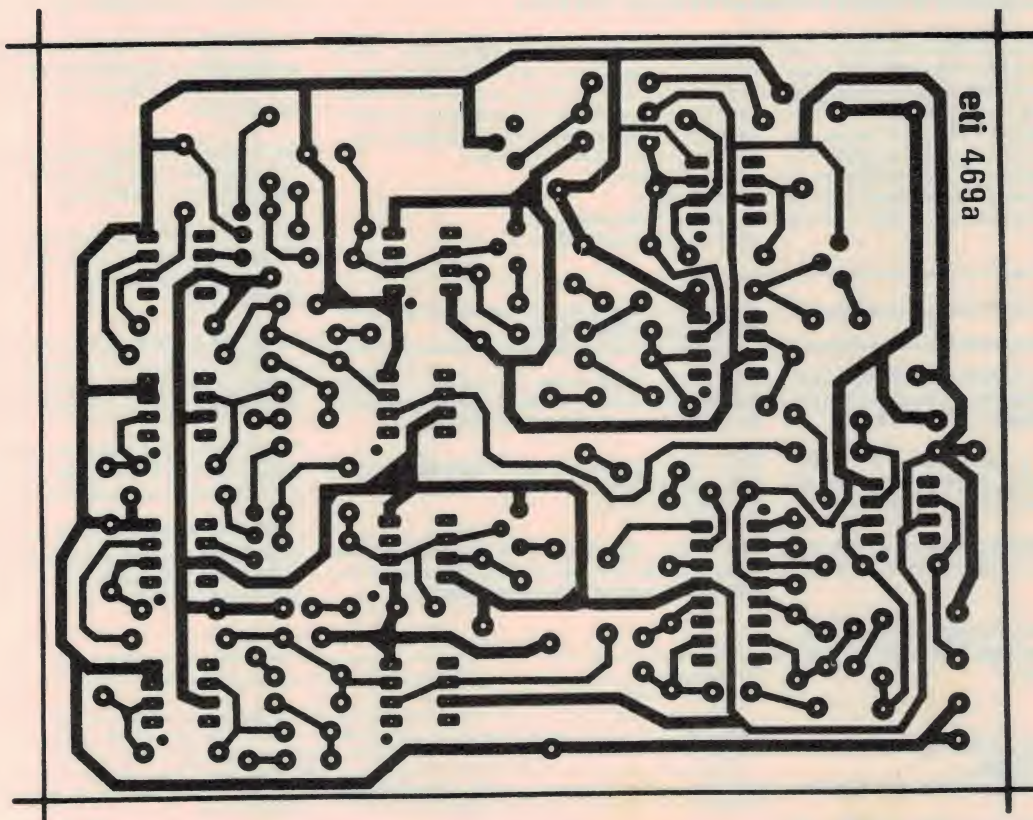
The film can now be developed by placing it emulsion side up on a table, pouring some Scotchcal 8500 developer on the surface and rubbing it with a clean tissue.

Further information on Scotchcal and pcb manufacture can be found in the September and December 1977 issues of ETI.

Please note that occasionally lack of space may prohibit the printing of blue type behind all pcbs. In this case the reader must resort to more conventional photographic techniques for pcb manufacture.



February 1982 ETI



Where readers can advertise — For Sale/Wanted/Swap/Join.

● We'll publish up to 24 words (maximum) totally free of charge for you, your club or your association. Copy **must** be with us by the 1st of the month preceding the month of issue. Please — **please** — print or type adverts clearly, **otherwise** it may not turn out as you intended! Every effort will be made to publish all adverts received; however, no responsibility for so doing is accepted or implied. Private adverts only will be accepted. We reserve the right to refuse adverts considered unsuitable.

● **Conditions:** Name and address plus phone number (if required) must be included within the 24 words. Reasonable abbreviations, such as 25 W RMS or 240 Vac, count as one word. Adverts must relate to electronics, audio, communications, computing etc — general adverts cannot be accepted.

Send your advert to:
ETI Mini-Mart,
4th Floor, 15 Boundary St,
Rushcutters Bay NSW 2011.

AUDIO

SELL: Tandberg reel to reel with inbuilt power amp, \$225 ono. Ring Rob for information, (03)465-6450, or write to 3 Valerie St, Lalor Vic. 3075.

JACKFIELDS, S/H, 6 mm mono, 19" rack-mounting, \$10-\$20. Also gramophone, wind-up console type. Ring Rod Hibberd, (02)406-5782.

FOR SALE: Escutcheon/front panel for ETI-414 Master Mixer, unused, in fair condition, \$15 ono. Gary (02)337-5348.

WANTED: Thorens TD150 turntable. Any condition but must be in working order. Phone (047)21-5591 (bh), ask for Mick Hope.

COMMUNICATIONS

FRG 7 in perfect order, 12 months old, \$300. Phone W. Hancock, (08)278-1092.

SELL: One pair STC UHF/FM mobile solid-state transceivers. 10 watt + output. Suit CB/amateur use. Professional quality equipment. Make a reasonable offer. (02)29-7708.

MISCELLANEOUS

FOR SALE: Philips colour TV game. 10 different games, with amateur and professional speeds and bat sizes. Phone (03)370-8298. \$50 onp.

SELL: BWD 539D dual trace oscilloscope, dc — 25 MHz with probes and manual. Perfect condition. \$500. (03)338-0521.

FOR SALE: 150 ohms 5% 25 watt resistors, c/w mounting feet. Quantity available 275, as new condition, IRC type DH. Ring (02)602-8657.

COPYRIGHT: The contents of Electronics Today International and associated publications is fully protected by the Commonwealth Copyright Act (1968).

Copyright extends to all written material, photographs, drawings, circuit diagrams and printed circuit boards. Although any form of reproduction is a breach of copyright, we are not concerned about individuals constructing projects for their own private use, nor by pop groups (for example) constructing one or more items for use in connection with their performances.

Commercial organisations should note that no project or part project described in Electronics Today International or associated publications may be offered for sale, or sold, in substantially or fully assembled form, unless a licence has been specifically obtained so to do from the publishers, Murray Publishers Pty Ltd, or from the copyright holders.

LIABILITY: Comments and test results on equipment reviewed refer to the particular item submitted for review and may not necessarily pertain to other units of the same make or model number. Whilst every effort has been made to ensure that all constructional projects referred to in this edition will operate as indicated efficiently and properly, it is noted that, for necessary components to manufacture the same will be available no responsibility whatsoever is accepted in respect of the failure of any component of the project to operate effectively or at all whether due to any fault in design or otherwise and no responsibility is accepted for the failure to obtain any components parts in respect of any such project. Further, no responsibility is accepted in respect of any injury or damage caused by any fault in the design of any such project as aforesaid. The Publisher accepts no responsibility for unsolicited manuscripts, illustrations or photographic material.

COMPUTERS

DREAM 6802 with 3 amp p/s, some minor bugs,
\$175 ONO. S. McCormack, 437 Anzac Hwy,
Camden Pk SA 5038.

SELL: Shugart 5" floppy disk drive, brand new in carton, \$250. McLean, 6/34 The Trongate, Granville NSW. Phone (02)682-4015 or 682-0324.

SALE: Sinclair ZX80 with transformer, space wars and two other tapes, three books. Works perfectly, \$195. Bennett, 6 Barilla Court, East Burwood Vic. (03)232-9001.

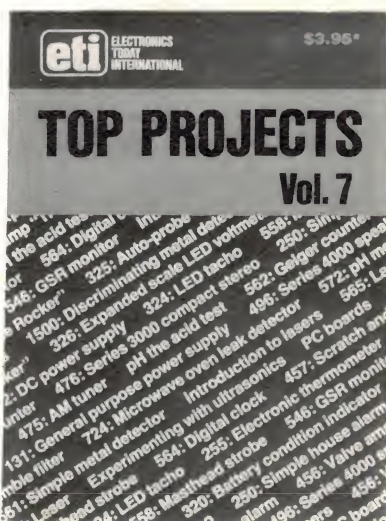
SELL: Super-80, 16K, complete with all IC sockets. Ready to use, tape and books, cables — urgent sale. \$380 ono. (02)522-9699.

ZX80, 4K + 8K ROM, tape player (Tandy CTR41), three manuals, two books, four newsletters, p/s, programs (Breakout, etc). Cost \$500, sell \$250. (03)725-7284.

PET COMMODORE 2001-8, as new, 8K RAM, green phosphor screen and cassette unit plus as much software as you can carry (on cassettes and magazines). \$700 or best offer. (02)517-1407.

TELETYPE KSR35, excellent condition, 20 mA I/F, \$200 ono. Also full set manuals for teletype mod. 32/33, \$25 ono. Norm (03)534-1192.

COMMODORE PET 2001, 8K, inbuilt VDU and cassette. BASIC course on tape; excellent condition. \$500 ono. 13/96 Burns Bay Rd, Lane Cove NSW 2066. (02)428-2191.



HERE IT IS!

Over 20 of our top-popularity projects from recent years' ETIs plus several projects from a few years back that have enjoyed renewed interest. All assembled in one big volume — there's something to suit every electronics enthusiast's interest, from the ETI-250 Simple House Alarm to the ETI-1500 Discriminating Metal Detector, from the ETI-325 Auto-probe to the ETI-562 Geiger Counter, from the ETI-724 Microwave Oven Leak Detector to the ETI-565 Laser. TWENTY projects, in all — PLUS: 'An Introduction to Lasers', 'pH — the Acid Test' and 'Experimenting With Ultrasonics'. Top Projects Vol. 7 also contains a Shoparound guide on where to obtain pc boards, front panels, kits and components for the projects between its covers.

ON SALE NOW AT NEWSAGENTS AND SELECTED ELECTRONICS SUPPLIERS. Or you can obtain a copy direct from ETI for \$3.95 plus 65 cents post and handling. Send your cheque or money order to ETI Magazine, 15 Boundary St, Rushcutters Bay NSW 2011. Ask for: 'Top Projects Vol. 7.'



LINN
SONDEK

AUTHORISED DEALER LIST

N.S.W

Riverina HiFi

Brookvale (02) 938 2664

Woollahra Electronics

Woollahra (02) 389 9625

HiFi Studio

Chatswood (02) 412 2210

N.S.W. Country

Wollongong HiFi

(042) 283 773

Newcastle HiFi

(049) 22400

A.C.T.

Abels Record & Audio Centre

Manuka, (062) 951 466

Victoria

Sound Craftsman

North Caulfield (03) 509 2444

Steve Bennet Audio

Geelong (052) 216 2011

South Australia

Blackwood Sound Centre

Blackwood (08) 278 1281

Grenfell Plaza HiFi

Adelaide (08) 515 017

The Sound Craftsmen

Hawthorne (08) 272 0314

Western Australia

Vince Ross Audio World

Perth (09) 321 2644

Queensland

Stereo Supplies

Brisbane (07) 229 2732

Disco & Stereo

Townsville (077) 723 470

the beginning!

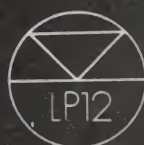
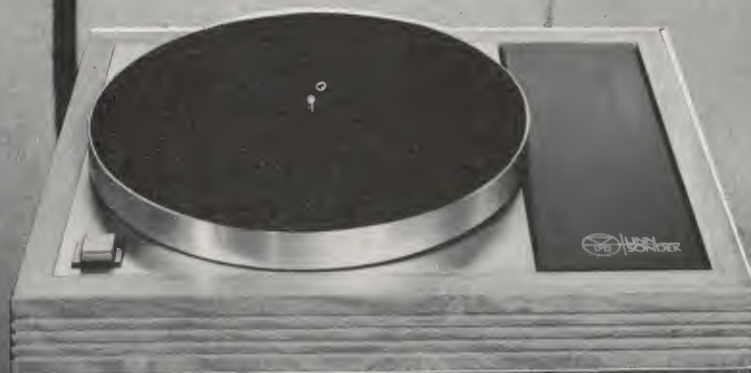


the beginning of a record playing chain is the record. If the turntable does not extract the musical information from the record, it is lost for ever. No amount of money spent further along the chain, on speakers for example, will recreate a signal which is lost at the beginning. In fact, you may only amplify original deficiencies by reproducing them more faithfully.

The Linn Sondek LP12 transcription turntable is designed and manufactured to extract as much information as possible from the modern long playing record. It is, quite simply, the link missing in so many play-back systems between your ear and the recorded performance.

If you can appreciate the differences between listening to a record on a good system and hearing something that approaches live music, then the logical place to start is with the Linn Sondek LP12

A product of integrity which offers proven value and performance



LINN
SONDEK

STOLMACK

Aiming for Perfection

Romney Road St Ives NSW
PO Box 139 St Ives 2075 Australia
Telephone (02) 4408441

Technics RS-M230 fully automated tape deck

If you want good performance but don't wish to be bothered with all those fiddly adjustments for tape type, bias, etc, that the dedicated audio buff just loves, then the Technics RS-M230 fully automated cassette deck could be just the thing for you. It offers excellent performance as well!

Louis Challis

TECHNICS RS-M230 TAPE DECK

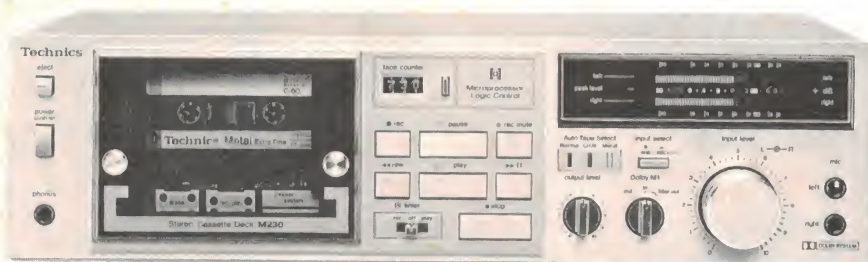
Dimensions: 430 mm wide × 119 mm high × 293 mm deep.

Weight: 5.1 kg

Price: \$329

Manufactured: In Japan by Matsushita Electric Corporation, Osaka, Japan.

Distributor: National Panasonic (Aust.) Pty Ltd, 95-99 Epping Rd, North Ryde NSW 2113.



THE TREND in the design and manufacture of cassette recorders is constantly changing as each Japanese manufacturer vies with his competitors to produce new features and various options to pander to the taste of the public, whose whims and desires have proved to be equally fickle.

If one leaves aside machines catering for those audiophiles who are looking for more powerful and more potent characteristics in the form of microprocessors and various control functions, one soon gains the impression that the Japanese designers are seeking to produce machines designed for lazy people. These contain automatic or automated functions to allow even the most non-technical user to utilise the machine with the least possible effort, this effort being limited to placing the cassette in

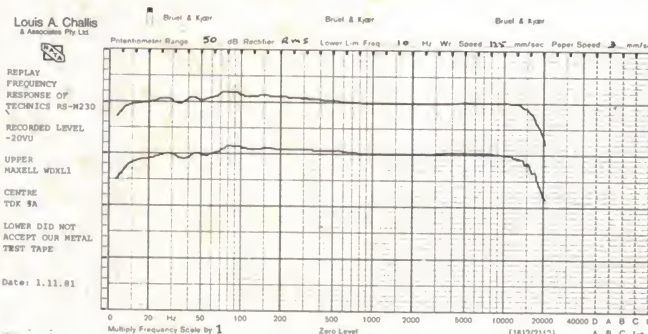
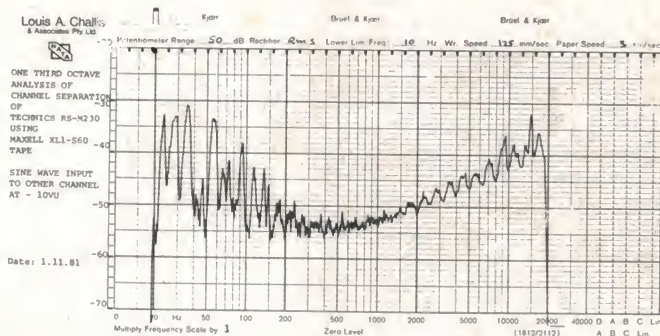
the machine and adjusting the volume for record or playback. Obviously if the machine is capable of selecting bias, equalisation and all other functions automatically, one has a machine which will satisfy the needs of the laziest members of our society and obviate the problems of those people who unreservedly claim they are incapable of mastering the 'complex techniques' of correctly using a conventional cassette recorder.

The RS-M230

The RS-M230 cassette deck incorporates a microprocessor to simplify operation, so that the selection and determination of bias and equalisation is automatically detected from the cassette body, so long as the cassette is correctly encoded with indents on the actual cassette body.

The deck contains, on the left hand side, a power 'on/off' switch and a cassette ejection button, a socket for headphones and a cassette well with a large clear removable acrylic front panel. In the centre of the deck is a three-digit counter, below which are a series of large microswitch touch buttons, with large buttons (or larger than normal buttons) being provided for pause, play and stop, and smaller buttons for record, record/mute, fast forward and rewind. A timer control function for an external timer unit is provided on the front panel for record, off and play, whilst on the right hand side of the deck is a large plasma display covering the range -20 to +8 VU with the individual segments operating in groups of three rather than individually.

From -20 to 0 the display is white,



whilst from 0 to +8 it is orange. Below the plasma display are three lights which indicate the automatic selection of gamma ferric oxide, chromium dioxide or metal tape, but which, as we found later, only function correctly if the tape cassette contains the correct slots in the rear of the individual cassette to activate the microswitches contained within the unit. The only other controls on the front panel are a Dolby in/out or FM pilot tone filter switch, a main volume control for input level and a similar control for output level, and a pair of sockets for microphones for left channel and right channel respectively.

The rear of the unit contains two pairs of coaxial sockets, a DIN socket and the mains lead, leading through to a standard 240 volt ac plug.

The front fascia of the unit is an aluminium extrusion, whilst the top is fabricated from folded steel. The sides, bottom and rear are a series of plastic moulding, which simplifies the installation, fixing and protection of all the other primary components. One interesting feature is the way that the plastic moulding has been fabricated to facilitate the reorientation of the transformers to optimise or minimise mains leakage induction into the magnetically sensitive elements, particularly the recording heads.

The unit contains one large beautifully laid-out motherboard, so that servicing become a veritable 'pushover' compared with previous generations of cassette recorders. The unit makes extensive use of large-scale integrated circuits. Special facilities are provided on two small satellite boards connected by ribbon cable and conventional wiring. These provide the electronic functions required by the plasma display functions and the motor drive electronic controls. The drive mechanism uses two motors with servo-control systems, and these incorporate a large, efficient

flywheel to assist regulation and a combination of plastic mouldings and light gauge steel fabrications to create a solid and reliable drive system.

On test

Technics inexplicably provided us with three sample tapes for our evaluation and the full significance of this did not make itself apparent until we actually started to conduct our tests. Whilst the standard gamma ferric oxide and chromium dioxide replay frequency test tapes that we normally use worked perfectly on the unit, our metal replay tape (circa 1980) would not function on this particular unit as it lacked the appropriate slots on the back. The frequency response on gamma ferric oxide and on chrome equivalent tapes is exemplary, the frequency response being ± 2 dB from 12 Hz to 17 kHz on the gamma ferric oxide, and equally flat and smooth with the TDK SA test tape. Whilst we recorded the replay response with the metal tape, this was incorrectly equalised on playback and therefore provided a ± 3 dB response from 18 Hz through to 17 kHz. It is clear that the overall linearity on the metal tape would have been equally as good if not better than that provided by the other two reference tapes.

The lesson of course from this is that if one intends to use such a machine with either pre-recorded metal tapes or any tapes recorded on another machine, it is essential that they contain the features provided by the latest tapes in terms of the knock-outs or slots to provide the correct performance.

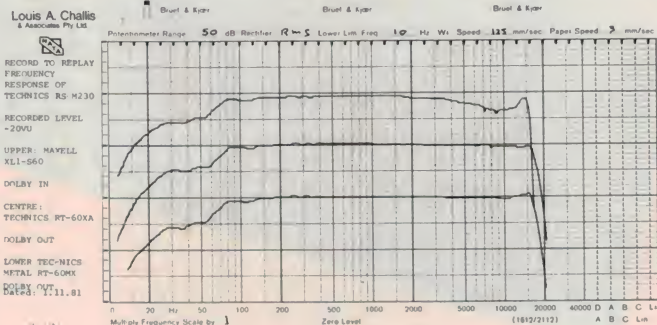
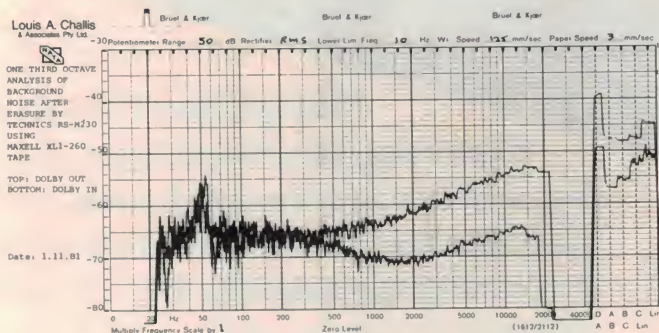
The record to replay response of the machine is not as good as its replay response but still provides good performance, being ± 3 dB from 45 Hz to 17 kHz on MAXELL XL1, 45 Hz to 17 kHz on Technics RT60XA and 45 Hz to 17.5 kHz with Technics Metal RT60Mx.

The difference between Dolby in and Dolby out is significant on this machine. With Dolby in the frequency response is not as flat as it is with Dolby out, and the saturation characteristics of the Dolby processor do leave their mark on the overall linearity at both medium and high recording levels. Nevertheless, the performance shown with the MAXELL XL1 tape indicates that the saturation level even at 0 VU on this machine is better than on many previous machines that we have evaluated.

The noise figure is particularly good, being 56 dB(A) with Dolby out and 65 dB(A) with Dolby in. These performance figures are good considering that they are for Dolby B and not Dolby C. One wonders whether a machine offering the best possible performance with Dolby B partially negates the need for more sophisticated and expensive noise reduction systems.

It is worthy of note that the primary components detected in the third octave noise spectrum are particularly smooth, and only the 50 Hz component shows up at all above the general electronic noise produced within the machine. This level is remarkably low and shows that the designers have taken care of mains leakage hum from the transformer and power supplies through to the associated electronics.

Channel separation is also good and at mid-frequency is better than 55 dB, only rising up to approximately 35 dB at the high frequency end and just over 30 dB at the very low frequency end. The distortion characteristics at 0 VU are also low, being 0.39% at 100 Hz, 0.05% at 1 kHz and 1.35% at 6.3 kHz. At -6 VU these figures have dropped dramatically to only 0.2% at 100 Hz and 1 kHz and 0.6% at 6.3 kHz. With MAXELL gamma ferric oxide tape the 3% third harmonic distortion is produced at +8 VU. The erasure ratio is also a very healthy -82 dB with gamma



Why did Tec New Class A



The legendary Class A sound
Class A amplifiers have long enjoyed a well deserved reputation for superb sound quality. Their drawback has been the comparatively low power output capability due to the sizeable amounts of heat generated.

Technics develop amplification?

The efficiency of Class B.

Since the advent and development of inefficient speakers requiring more powerful amplifiers for adequate driving, another class of amplifier has become almost universal in its application – Class B.

Certainly, in respect of its power producing capabilities, this system is without peer.

However, Class B circuitry also has its drawbacks, namely crossover and switching distortion.

Technics New Class A solution. The ideal amplifier should therefore combine the sound quality of Class A with the efficiency of Class B.

And Technics have achieved this goal with the development of their New Class A design. Now, crossover and switching distortion are things of the past – totally eliminated by Technics innovative technology.

Linear feedback. In spite of this valuable advance, Technics did not rest there.

Further studies on negative feedback resulted in another unique Technics development – Linear Feedback.

By using the technique of applying multiple feedback loops within the amplifier

circuitry, distortion caused by amplification stages has been reduced almost to zero.

Power amplifier SE-A5. A superb example of Technics New Class A producing 120 watts per channel for only 0.002% THD over the frequency spectrum of 20-20,000Hz.

Control amplifier SU-A6. A highly advanced unit with many functions and facilities, including an 'extra' bass control – Super Bass.

This can extend the bass response by as much as an octave without causing bass boominess to adjacent bass frequencies.

Whilst major controls are located on the main fascia, all other controls are hidden behind a hinged glass door running the full length of the panel.

Technics have always been in the forefront of amplifier design.

That's why they constantly search for further improvements in quality.

And that philosophy led to the development of New Class A.

Of course all Technics components carry a full two year warranty.

Technics

Expanding the music experience.



MEASURED PERFORMANCE OF TECHNICS RS-M230

S.N.100505

RECORD TO REPLAY FREQUENCY RESPONSE AT -20VU:

Tape	Dolby	Lower - 3dB Point	Max. Point and Frequency	Upper - 3dB Point
Maxell XLI-S60	In	58Hz	-	16kHz
Technics RT-60XA	Out	60Hz	-	17kHz
Technics Metal RT-60MX	Out	60Hz	0.5dB/16kHz	17kHz

SPEED ACCURACY: -0.75%

WOW AND FLUTTER:

WOW:	Average	0.2% p-p
FLUTTER:	Unweighted	0.16% RMS
	Weighted	0.03% RMS

HARMONIC DISTORTION:

Tape: Maxell XLI-S60

		100Hz	1kHz	6.3kHz
OVU:	2nd	-54.0	53.6	-46.2dB
	3rd	-49.8	-47.3	-38.4dB
	4th	-	-	-58.8dB
	5th	-61.9	-	-dB
	T.H.D.	0.39	0.048	1.3%
-6VU:	2nd	-	-	-47.0dB
	3rd	-54.1	-54.4	-48.5dB
	4th	-	-	-dB
	5th	-	-	-dB
	T.H.D.	0.20	0.19	0.58%

MAXIMUM INPUT LEVEL:

(for 3% third harmonic distortion at 1kHz)

Tape: Maxell CLI-S60 +8VU

DYNAMIC RANGE:

Tape: Maxell XLI-S60

Dolby Out	53dB(Lin)	56dB(A)
Dolby In	59dB(Lin)	65dB(A)

ERASURE RATIO:

(for 1kHz signal recorded at OVU)

Tape:	Maxell XLI-S60	82.3dB
Tape:	Technics Metal RT-60MX	78.6dB

ferric oxide tape and -78 dB with metal tape.

The wow and flutter figures are particularly low, with a 0.2% wow peak to peak, an unweighted flutter of 0.16% RMS and a weighted figure of only 0.03% RMS.

The objective testing of this machine shows it to have above average performance, with an upper frequency limit that is quite good enough to satisfy the average user — particularly so for one for whom the trouble of making fine adjustments or making specific changes in the operating procedure seems to be 'just too much'.

To the ear

One quickly learns with this machine that provided the cassettes are of the latest generation it presents the absolute minimum of trouble in use. It could be classified as analagous to a car with automatic transmission; it is easy to use, easy to drive and the results it produces are good.

I played a large number of pre-recorded tapes, some encoded for Dolby C. Many of these were pre-recorded tapes which I produced for testing other machines. One of these tapes was the

first of the Mobile Fidelity Sound Lab's pre-recorded tapes with slow speed mastering using the latest BASF chromium dioxide tape. With pre-recorded tapes of this quality the performance of the machine is truly outstanding, but the title I was sent was 'The Power and the Majesty', with choo-choo trains on one side and the sounds of a storm on the other. I believe they produce other tapes with music and only hope their fidelity is as good as the appetiser I was sent.

The RS-M230 exhibited exemplary reproduction, most of the time being comparable with many much more expensive machines with many more controls and fine adjustments.

Recording with this machine proved to be equally easy, and it occurred to me that a machine offering these features combined with the auto-record functions of the RSM51 cassette deck, (see

ETI, March 1981) would result in a machine designed for the non-technical type who is prepared to record his own tapes without knowing quite how to do it.

The RS-M230 may not be a cheap machine, but it provides excellent automatic facilities for all adjustments of tape, type of tape and controls. It would even suit a disabled or a blind person, and on top of these facilities offers excellent performance. ●

Absolute copyright in this review and accompanying measurements is owned by Electronics Today International. Under no circumstances may any review or part thereof be reprinted or incorporated in any reprint or used in any advertising or promotion without the express written agreement of the Managing Editor.

INTERGRATED P.A. AMPLIFIER SYSTEMS FROM AUDITEC PROFESSIONAL AUDIO PRODUCTS

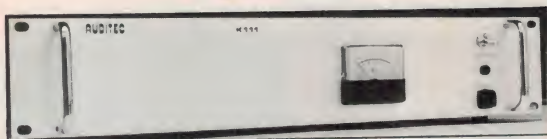
BALANCED MICROPHONE INPUTS; 100V, 70V, 50V, BALANCED LINE AND VOICE COIL OUTPUTS; CANNON INPUT AND OUTPUT CONNECTORS; 3 1/2" RACK MOUNTING; BASS, TREBLE AND VOLUME CONTROLS ON EACH INPUT CHANNEL; MUTING ON MUSIC CHANNEL.



K 109 2 INPUT CHANNELS, 120 WATTS
\$291.28

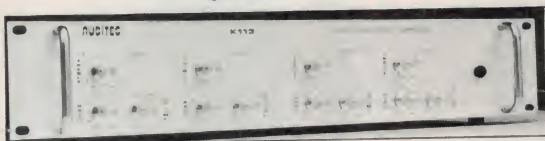


K 110 4 INPUT CHANNELS, 120 WATTS
\$359.48



K 111 60 WATT POWER AMPLIFIER
\$202.82

K 112 120 WATT POWER AMPLIFIER
\$226.60



K 113 4 CHANNEL ADD-ON MIXER
(PLUGS INTO K 109, K 110, K 111, K 112)
\$162.70

FOR ILLUSTRATED LITERATURE
ON THESE AMPLIFIERS, WRITE TO

AUDITEC Australia Pty. Ltd.

10 Waitara Avenue, Waitara N.S.W. 2077

Or Phone: NSW-AUDITEC (02) 48 4116; QLD-DELSOUND (07) 229 6155; VIC-ZEPHYR (03) 568 2922; S.A.-NEIL MULLER (08) 272 8011.

RECOMMENDED PRICES PLUS SALES TAX IF APPLICABLE
PRICES MAY BE SLIGHTLY HIGHER INTERSTATE

Not Just Speaker Wire



Conventional speaker wire limits the performance of your sound system by decreasing power output, restricting dynamic range, and reducing clarity and definition. You can significantly improve the performance of your audio system by switching from your present speaker wire to Monster Cable.

Constructed of over 500 strands of high purity copper in a unique configuration, Monster Cable is specifically engineered for low resistance, low capacitance, and low inductance. The Results?

Deeper, tighter bass.

Maximum power transfer.

Increased clarity and definition.

Wider dynamic range.

Even low-powered systems show a remarkable improvement. Recommended by leading audio manufacturers, Monster Cable is safe to use with all amplifiers and receivers, regardless of design.

Don't be deceived by imitations. If it doesn't say Monster Cable you're not getting all the performance you paid for.

MONSTER CABLE

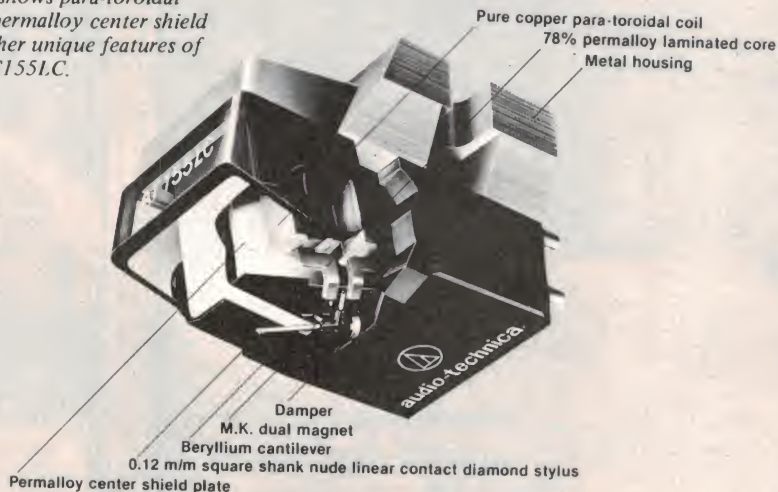
DISTRIBUTED BY CONVOY SYDNEY (02) 358 2088

Available from: N.S.W.—DUTY FREE TRAVELLERS SUPPLIES Sydney • CAMPBELLTOWN HI FI Campbelltown • LEISURE SOUND City, Parramatta, Artarmon • NEWCASTLE HI FI Newcastle • PITMANS Wagga • RUSSIN ELECTRONICS Ashfield • DAVE RYALL ELECTRONICS Dee Why • SPRINGWOOD HI FI Springwood • TAMWORTH HI FI Tamworth • LEN WALLIS AUDIO Lane Cove • WOOLLAHRA ELECTRONICS Woollahra • WOLLONGONG HI FI Wollongong • EASTERN HI FI Newcastle • ACT—DURATONE HI FI Phillip • KINGSTON HI FI Kingston • VICTORIA—NATSOUND Melbourne • BOON SOUND Wodonga • EAST COAST AUDIO Albert Park • SOUNDCRAFTSMAN Nth. Caulfield • TIVOLI HI FI Hawthorn • STEVE BENNETT AUDIO Geelong • QLD.—DISCO & STEREO SUPPLIES Townsville • GOLD COAST HI FI Southport • HANDO HI FI Toowoong • HI FI SALES Redcliffe • HIGHWAY SOUND Mt. Isa • REG MILLS STEREO Buranda • STEREO SUPPLIES Brisbane • STEREO WORLD Cairns • STH. AUST.—ASLIN HI FI Mt. Gambier • BLACKWOOD SOUND Blackwood • GRENFELL PLAZA HI FI Adelaide • SOUNDCRAFTSMAN Hawthorne • TRACK HI FI Adelaide • W.A.—ALBERTS Perth • E. Victoria Park, Balga, Freemantle • THE AUDIO CENTRE West Perth • AUDIO DISTRIBUTORS Mosman Park • JAPAN HI FI Victoria Park • LESLIE LEONARDS HI FI East Perth • NORTH WEST AUDIO Karratha • TAS.—BEL CANTO Hobart • UNITED ELECTRONICS Launceston • N.T.—RADIO PARTS Darwin.

AUDIO TECHNICAS NEW "Para-Toroidal" 100 SERIES CARTRIDGES

The top model of the AT100 Series, is the AT155LC. Frequency response is an incredible 5Hz to 35kHz, with channel separation an outstanding 32dB at 1kHz. Left and right channels are physically separated by a permalloy centre shield to make possible extremely low electrical crosstalk of below -40dB. A linear contact natural nude diamond stylus and deluxe beryllium cantilever also contribute to the AT155LC's superb sound reproduction accuracy. The AT155LC and the other new para-toroidal models — the AT140LC, the AT130E, the AT125LC and the AT120E — offer the audiophiles a wide selection of prices and performances all with the recognizably better sound and value which sets Audio-Technica Dual Magnet models apart from conventional MM models. Let's review our basics for a moment: the two toroidal coils used in each Audio-Technica cartridge, wound on a special winding machine, concentrate magnetic flux within the circular ring. Then the coils are integrated with the magnetic circuit in such a way as to prevent generating losses. This results in increased efficiency and linearity can be maintained over a wider frequency range.

Model AT155LC. Cutaway photo shows para-toroidal coils, permalloy center shield and other unique features of the AT155LC.



Available at all main Audio Dealers, but should you have any problems contact:

THE MAURICE CHAPMAN GROUP PTY. LTD.

NSW (02) 438 3111; VIC (03) 818 1730; WA (09) 381 6044; QLD (07) 341 1166; SA (08) 272 8011.



THE 30 CM CONVERTIBLE: MONITOR AND T.V. SET



\$139.50

If you need a monitor for your computer, consider this dual purpose set. A fully-fledged B/W TV set with RCA input for your computer. Alternatively, you could use the set in conjunction with a video camera as a closed circuit TV system. A simple switch allows easy change-over from TV to monitor. Available only from:

PHILIPS LOUDSPEAKERS

See us at Northpoint Hi-Fi for the new range of Philips loudspeakers and crossover networks. We have the ETI 4000 series speakers on display as well as other Philips kits. You can buy sets with or without boxes, any way you like. Come in for an audition, or write for further information.



northpoint hi-fi

100 Miller St, North Sydney.
Ph 922-7780.

480

**In two years the Nakamichi 480
Cassette Deck has made a lot of
friends for many good reasons, here
are a few:—**

- Soft eject front loading cassette with removable cassette cover allows easy maintenance for peak performance.
- Electronic control of all transport functions allows optional remote control from your arm-chair.
- Easy to read wide range peak responding meter system allows accurate monitoring of record and play levels.
- Ergonomic placement of all front panel controls allows first time users to obtain superb performance.
- The 480 takes advantage of the better performance available from metal tape and will faithfully reproduce the totality of your source material.

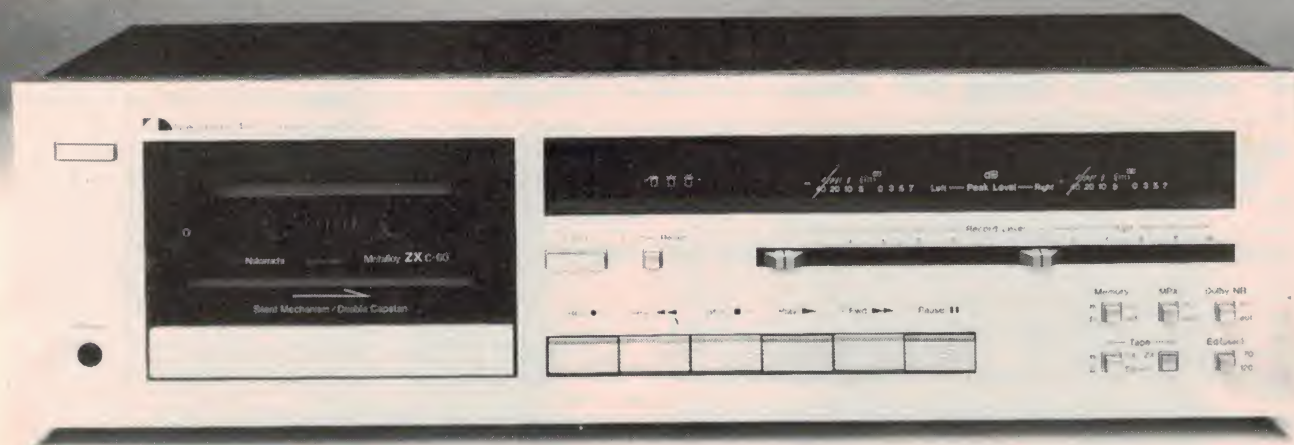
We have kept the best reason till last. You can have the performance packed 480 for only \$399. Optional remote control \$35.

Ask your nearest dealer for a listen — your ears will thank you.

For complete information on Nakamichi's 480 Cassette Deck
write to Convoy International Pty. Ltd.,
4 Dowling Street, Woolloomooloo, N.S.W. 2011.



Nakamichi



Sansui TU-S33 stereo tuner



Louis Challis

The TU-S33 tuner has been developed by Sansui to match exactly the characteristics and appearance of the AU-D22 and AU-D33 amplifiers, and for anyone living in a city radio situation, Louis Challis reckons you could do worse than this tuner for your radio reception.

SANSUI TU-S33 STEREO TUNER

Dimensions: 430 mm wide x 76 mm high x 272 mm deep
Weight: 3.5 kg
Price: \$269 rrp
Manufacturer: Sansui Electric Co, Tokyo
Distributor: Vanfi, 198 Normanby Rd, South Melbourne 3205

EACH TIME one of the major manufacturers releases a new series of amplifiers, it seems they feel duty bound to supplement the release with an equivalent range of tuners to match both the technical and physical characteristics of the new series. With the release of the AU-D22 and AU-D33 Super Feed Forward Amplifiers, Sansui have released an inexpensive tuner offering features that the intending purchaser should really appreciate. In keeping with

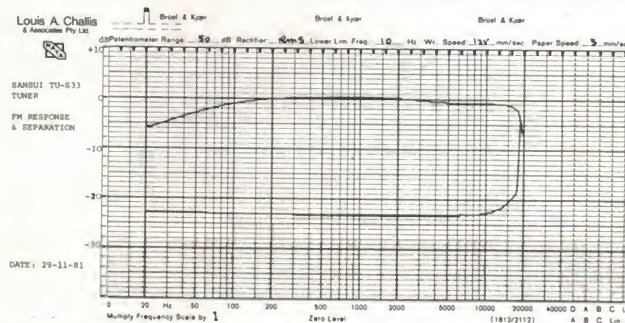
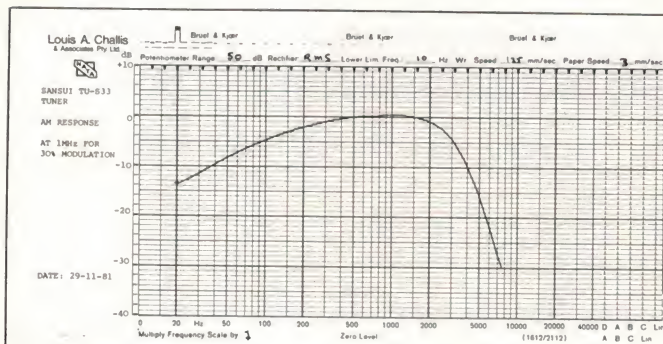
Sansui's policy these have been released in both silver and black to cater for your personal taste.

Appearance and features

The TU-S33 Servo-Locked Tuner is an attractive piece of equipment. The front panel is moulded from black plastic to minimise the manufacturing costs and features a very wide slide rule dial in the upper section, with its large tuning knob at the right hand end, and the minimal number of controls in the section immediately below. The slide rule dial is interesting and innovative, in that the frequencies are softly illuminated from behind whilst the tuning indication is provided by a little slide bar.

This features a central vertical thin red LED, which is flanked on either side by triangular yellow LEDs which look like little arrows. On the FM mode these arrows indicate the direction towards which the tuning dial should be moved to correctly tune in to the station. At the correct position both arrows light up, and the yellow 'phase locked' light comes on as well. In the AM mode, one must make use of the signal strength metering facilities provided in the lower quadrant or use your hearing to correctly tune to the station.

On the left hand side of the lower quadrant is the power on/off switch. In the middle of the panel are LEDs which are, respectively, red, to indicate the



selection of an FM stereo station, five green LEDs to indicate the strength of the incoming FM or AM signal, and a yellow LED to indicate that the station has been locked in by the phase lock loop servo system in the FM tuning section. Only three other switches are provided, one for a noise canceller on/off, about which we will say more later, an AM/FM selector switch, and on the right hand end a muting mode switch which allows you to automatically mute the lower strength signals on AM or FM to reduce spurious pick-up.

The rear of the receiver features the normal balanced 300 and unbalanced 75 ohm terminals for FM reception. These terminals are supplemented by two terminals marked 'loop antenna', and lo and behold, inside the box is a small moulded plastic loop antenna complete with integral self-adhesive bracket and short leads complete with spade lugs. The loop is designed to be attached to the wall, or alternatively to be mounted clear of the receiver, to provide directional facility. For those of you who are too young to remember, back in the 30s and 40s the loop antenna was the favoured method of optimising signal strength from an incoming station whilst simultaneously providing maximum rejection for unwanted spurious signals, be they from a refrigerator, washing machine or even unwanted industrial magnetic transmission from a nearby factory.

With the development of ferrite loop antennae, the loop antenna lost favour, even though its directional characteristics are superior to the ferrite loop stick. The only other receiver that we have recently seen offering this facility was the Audio Sound Model AM.101, which provided a less attractive although in some respects more sensitive loop, with similar directional characteristics.

The only other fittings on the rear

panel are the two coaxial sockets to feed through to the main amplifier, and much to our surprise an unswitched 240 V outlet, which I was sure had been banned by the Australian Electricity Supply Authority ruling.

The chassis and remainder of the cabinet are fabricated from steel, as is the rear panel, and the unit perfectly matches the physical characteristics of the AU-D22 and the AU-D33 integrated amplifiers. The inside of the unit is both simple and straightforward, in that it incorporates one large printed circuit board which has obviously been designed for a range of possible receivers. There are a surprisingly large number of blank holes, which we must presume were either designed for the matching long-wave version of this receiver, or alternatively for a similar type of receiver with higher sensitivity. The printed circuit is, however, beautifully laid out, featuring test points and clear labelling of all components, making servicing a delightfully simple task.

The most interesting feature of this unit, however, is not the electronics, but rather the mechanical system with which the slide-rule dial linkage works. This is probably one of the most complex cord drive systems we have seen for many years. It is only eclipsed by the actual method by which the power is fed through to the slide-rule dial. The unit incorporates no less than seven individual wheels over which the dial cord must pass, excluding the two separate small grooved wheels on the counter-weighted drive. Obviously the designers were worried about the reliability and performance of this system, and have taken far more trouble with its design concept than in other units which we have seen in the past few years.

By contrast the electrical connection for the four wires leading through to the three LEDs on the dial assembly features an umbilical system which looks

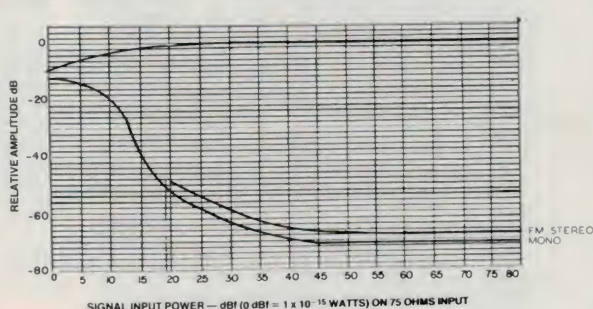
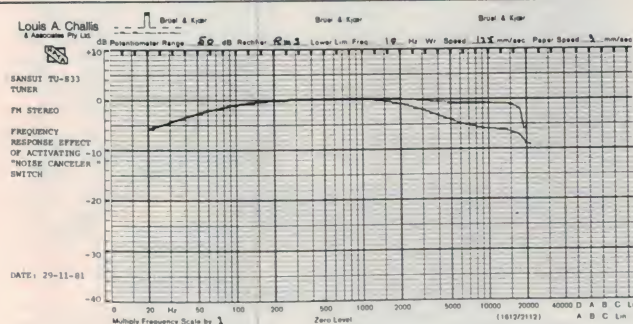
more like Heath Robinson that the Japanese technology we have seen developing over the past few years. The wiring harness incorporates a vertical section of plastic spaghetti, located at almost the centre of the printed circuit. From the top of this vertical stand the wires droop as an unprotected twisted harness, which is then connected to the carriage on the slide-rule dial through a stiffened section of clear plastic tubing 95 mm long. In watching this operate, I had the horrible fear that the wire harness was going to catch on one of the transistors lying in the wire's path. However, each time the dreaded problem did not arise, and the unit continued to function well. With the cover off it was a most interesting conversation piece.

The layout and construction of the printed circuit board are typical of the latest advances in Japanese manufacturing technique, featuring the minimum number of hand-soldered connections and the maximum utilisation of pre-formed or moulded modules to minimise the manual insertion and assembly of the components both on the board and within the chassis.

On test

The objective performance of the unit is generally excellent, although some of the figures fall short of those claimed by the manufacturers in their trade literature.

The usable sensitivity on FM mono, for 26 dB signal-to-noise ratio, is 13 dBf, which is good but not outstanding. The normal stereo sensitivity for 46 dB signal-to-noise ratio was not measurable, in that the internal threshold for the stereo signal detection occurs at 19 dBf for a 50 dB signal-to-noise ratio, which is quite a commendable figure. The ultimate signal-to-noise ratio on stereo is 68 dB, whilst that on



Name or E-I. And win a S--r

If you can fill in the gaps you're on your way to winning the prize.
And what a prize it is. The Star Video cassette library.

All the excitement of your favourite movies will be at
your fingertips. Star Video library features new releases
like Cabaret, Straw Dogs, Bilitis, The Story of O.

Classics like Intermezzo, Spellbound, Rebecca.

Children's greats like Treasure Island and Robin
Hood. And educational cassettes presented by experts



r names.

Video cassette library.

like Alan Seale, Dr. Wright, Charmaine Solomon. To win the Star Video cassette library you have to fill in the gaps in the name of this magazine.

There's a total of \$25,000 worth of prizes in the Name our Names contest. In Wheels and Two Wheels you could win a MiGi sports car valued at \$7,200.

In Revs and Modern Motor you could win a Kawasaki K175 trail-bike, Eurovox car stereo, Bob Jane mag wheels and tyres, Astraview sunroof and a Perfect Tune car cylinder head conversion valued at over \$2,000. In Modern Boating and Modern Fishing you could win a Haines Hunter runabout V133 outboard, 55 h.p. Tohatsu outboard motor and D.A.M. fishing tackle valued at \$5,290. In Outdoors and Overlander you could win a Jayco Jayfinch camper trailer valued at \$4,600.

In Australian Golf and Rugby League Week you could win Dunlop golf gear, a Sony video recorder and Star Video sports library valued at \$3,400.

The name of this magazine is:

E - I.

Read the conditions, fill in your entry form and mail it to Name our Names, Murray Publishers Pty. Ltd., 154 Clarence Street, Sydney. The first correct entry opened wins the Star Video cassette library.

Name _____

Address _____

Postcode _____ Telephone No: _____

Conditions of Entry: 1. Only entries received by the closing date will be accepted and proof of posting will not be considered as proof of entry. 2. The Judges' and company's decision is final and no correspondence will be entered into. 3. All entries remain the property of the Editor. 4. The winner will be notified by registered mail and the name published in the June issue of this magazine. 5. The prize is not redeemable in cash, nor transferable to a third party, except where the winner is under 16 years of age, when the prize in total shall be delivered to the care of a parent or guardian. 6. Each entry must be handwritten on an original coupon printed in this magazine except in those States where local laws prohibit this limitation in which case an original handwritten entry in the same format as the coupon on plain paper will be acceptable. 7. Employees, and their relatives of Murray Publishers Pty. Ltd., or their related companies or agencies are ineligible to enter. 8. Submission of an entry to this competition indicates acceptance of the above conditions, and no claim of a legal nature will be entertained as a result of such participation by any contestant. Closing date, April 30th, 1982. Permit No: TC81/1735.



MEASURED PERFORMANCE OF: SANSUI TU - S33

S.N.: 831090017

FM TUNER SECTION: (measured at 98Hz unless otherwise stated)

FREQUENCY RANGE: 88 - 108MHz

USABLE SENSITIVITY:

(40kHz deviation)

Mono for S/N 26dB 13dBf

Stereo for S/N 46dB Not measureable due to muting

Stereo threshold 19dBf @ 50dB S/N ratio

SIGNAL TO NOISE RATIO: (see curves)

(40kHz deviation)

Mono 71dB

Stereo 68dB

DISTORTION:

1kHz signal @ 50dBf 0.15% Stereo 0.09% Mono

FREQUENCY RESPONSE: (see curves)

50Hz - 18kHz

SEPARATION: (see curves)

23dB

AM TUNER SECTION

Frequency Range 525-1600kHz

ANTENNA "True Loop"

RESPONSE @ 1mHz 150 - 2500Hz

FM QUIETING AND S/N RATIOS

Input Level dBf	Mode = Mono 2m=300	Dev = 40kHz
	Modulated output dB	Noise Output dB
800	0	-71
70	0	-71
60	0	-71
50	0	-71
40	0	-71
30	-0.1	-62
20	-0.2	-51
10	-3.5	-18.0
0	-9.0	-12.0

Input Level dBf	Mode = Stereo 2m=300	Dev = 40kHz
	Modulated output dB	Noise Output dB
80	0	-68
70	0	-68
60	0	-68
50	0	-67.5
40	0	-65.5
30	0	-59.0
20	-0.1	-49.4

Muting Occurs

night. All the city FM stations are readily received at adequate signal strength on a 'rabbit's ear' antenna, and the noise canceller provides no great listening advantage under these conditions. The quality of reception is excellent and the level of distortion remarkably low. The major limitation is the stations' transmissions, not the receiver.

The TU-S33 receiver is a well-designed unit, offering good but not outstanding performance, designed to provide a happy compromise between the constraints of appearance, performance and cost. For city listening this unit must rate very highly, but it is not recommended for people living distances of 25 km or more from an FM station, nor at distances of 50 km or more from the AM stations you want to hear, unless you are prepared to use an external antenna to develop the full potential of the unit.

mono is 71 dB. The bandwidth on FM stereo and mono is 50 Hz to 17 kHz, with a very sharp drop-off to the 19 kHz pilot tone. This frequency response is smooth and quite adequate for good stereo listening. The channel separation falls short of the manufacturer's claim, providing 25 dB of separation all the way from 20 Hz through to 6 kHz, dropping gradually to 20 dB at just under 15 kHz. As the channel separation on the records played by the FM stations is not significantly better than this figure, this does not constitute a serious disability in the receiver.

When the noise canceller on the front panel is activated, the top end of the frequency is attenuated by approximately 6 dB over the frequency region 6 kHz to 17 kHz. This difference in frequency response would not be readily audible unless you have sharp hearing, and does not constitute a significant disability.

The distortion characteristics on FM are excellent, and at 50 dBf signal level the distortion is a modest 0.16% on stereo and 0.09% on mono. By contrast the AM frequency response, in keeping with the majority of other tuners on the market, provides a relatively peaky frequency response, with a bandwidth of only 150 Hz to 2.5 kHz. This is suitable for pop music but not as suitable for the better quality AM transmissions available in this country.

In use

The subjective assessment of the unit was carried out at home under conditions which could be described as typical for an inner urban situation in any major city. No FM station is closer than 8 km and no AM station closer than 20 km from the point of reception. Under these conditions only inner-city AM stations are audible during the daytime, plus closer country stations at

Absolute copyright in this review and accompanying measurements is owned by Electronics Today International. Under no circumstances may any review or part thereof be reprinted or incorporated in any reprint or used in any advertising or promotion without the express written agreement of the Managing Editor.

NEC PC-8000

A low cost, high performance microcomputer system designed for your needs..from \$1,500

PC8000 combines the most wanted features of several leading microcomputers together with a few wonders of its own

includes sales tax



Check these features..

- 5 user-programmable function keys. Up to 10 different user-defined routines can be activated using these keys and the shift key.
- 82-key keyboard features function keys and numeric keypad.
- 248-symbol character set.
- Z-80A equivalent microprocessor, running at 4MHz.
- CP/M™ disk operating system compatibility.
- N-key rollover.
- Standard memory features 24K bytes of ROM and 32K bytes or RAM
- 64K RAM is available with the PC-8012A/I/O unit.

- 160 x 100 matrix of high resolution graphics, powerful control directly from the keyboard.
- Interfaces include color monitor, monochromatic monitor, audio cassette, Centronics™ printer.
- Screen formats of 20 or 25 lines and 36, 40, 72 or 80 characters per line, with adjustable scrolling window.

- A powerful editor simplifies programming and includes 4-way cursor control, character insert and delete.
- Terminal mode available with a single command.
- I/O unit for plug-in circuit boards.

INTRODUCTORY OFFER
FREE MEMBERSHIP IN THE
'AUSTRALIAN BEGINNING'
NORMALLY \$100

HANIMEX

means business

For Authorised Dealers phone:

SYDNEY 938-0400 ● MELBOURNE 64-1111 ● BRISBANE 262-7555 ● ADELAIDE 46-9031 ● PERTH 381-4622

LET THE AUSTRALIAN BEGINNING

BRING MAINFRAME POWER INTO YOUR HOME OR OFFICE



THE AUSTRALIAN BEGINNING PTY. LTD.

The Australian Beginning Pty. Ltd. is an Australian company, with Australian based computer facilities, using the Australian Telecommunications network to offer Australian clients Australian information services and software.

WE ARE PROUD TO ANNOUNCE THE LAUNCHING OF AUSTRALIA'S FIRST MICROCOMPUTER INFORMATION UTILITY

The AUSTRALIAN BEGINNING is Australia's first microcomputer information utility, aimed at giving the average microcomputer user access to the computer data banks and also massive storage space previously only available to large Mainframe installations. The era of home computers has now officially begun in Australia, now that the AUSTRALIAN BEGINNING is here; as now, any small businessman or student can have on his desk for an extremely small cost, a system that has the level of storage power and access to data banks for which only a few years ago, government departments and large private users were paying millions of dollars.

The AUSTRALIAN BEGINNING can be accessed through a number of 'approved' personal computers, and terminals, by use of an acoustic coupler or modem.

Users will receive a number of benefits which will include:

INFORMATION SERVICES

Members will have access to a number of information sources which will include the latest news, sports results, financial reports, and farm information.

NATIONWIDE COMMUNICATION

Members will be able, also, to communicate nationwide with other AUSTRALIAN BEGINNING members through our system.

THE AUSTRALIAN BEGINNING
RECOMMENDS 3M DISKETTES

SOFTWARE BANK

Users will have access to a myriad of computer programs that will include entertainment, educational aids, programming and diagnostic tools, and financial applications.

MAINFRAME POWER

Users will have the capability to make use of the Mainframe's huge storage capacity by using any of our large programs, or storing your large programs on our system.

SHOP AT HOME

You can take advantage of our 'shopping by computer' system to get the best prices on a number of popular consumer items.

EXTREMELY EASY TO USE

You do not have to be a computer programmer to make use of the AUSTRALIAN BEGINNING. All of the instructions are in everyday English, so that even the younger members of your family will be able to operate the system.

LOW COST

While services like these used to cost tens of thousands of dollars to the government departments and large corporations who used them, they are now available to you for less than the cost of a packet of cigarettes a day for the 'average' user.

You can join the AUSTRALIAN BEGINNING by paying a one-time joining fee of \$100, and a small hourly user charge of \$10 an hour 8 a.m. - 6 p.m. and \$4.50 an hour 6 p.m. - 8 a.m.

TO JOIN THE AUSTRALIAN BEGINNING FAMILY, AND TAKE ADVANTAGE OF THE EXCITING SERVICES WE WILL BE OFFERING, PLEASE COMPLETE THE COUPON BELOW:

"Please note this service is scheduled to be available to subscribers by 1st March 1982"

MEMBERSHIP REQUEST

Yes, I think the idea of the AUSTRALIAN BEGINNING is great! I enclose \$100 so please send me my user manual and password.

☐ I have a computer, Brand.....

Model.....

☐ Please send me information on low cost equipment packages I can use to take advantage of the AUSTRALIAN BEGINNING'S services.

NAME:

ADDRESS:

CITY:

STATE: POSTCODE:

PHONE:

THE AUSTRALIAN BEGINNING
(SALES) PTY.LTD.,

364 LaTrobe Street,
Melbourne, Victoria, 3000.
Tel: (03)329.7998

☐ I am interested, but I need more information.

DEALER INQUIRIES INVITED



Electronics Today International is published by Murray Publishers Pty Ltd, 15 Boundary St, Rushcutters Bay NSW 2011. It is printed (in 1982) by Offset Alpine, cnr. Wetherill and Derby Sts, Silverwater NSW, and distributed by Gordon and Gotch.

Editor

Roger Harrison VK2ZTB

Technical Editor

David Tilbrook VK2YMI

Production Editor

Jane Clarke B.A. (Hons)

Advertising Production

John Gerrie

Editorial Staff

William Fisher B.Sc. (Hons)

J.B. Scott B.Sc./B.E. (Hons)

VK2YBN

Jan Vernon B.A.

David Currie

Geoff Nicholls B.Sc./B.E.

Layout

Bill Crump

Githa Pilbrow

Typesetting

Julie Hewlett

Reader Services

Pam Lord

Managing Editor

Collyn Rivers

Acoustical Consultants

Louis Challis & Associates

Mail enquiries: There is no charge for replies, but a foolscap-sized, stamped, addressed envelope must be enclosed. Queries relating to projects can only be answered if related to the item as published. We cannot advise on modifications to projects, other than errata or addenda, nor if a project has been modified or if components are other than specified. We try to answer letters as soon as possible. Difficult questions may take time to answer.

Phone enquiries: We can only answer readers' technical enquiries by telephone after 4.30 pm. In enquiring by telephone about back issues or photostats, please ask for the Subscriptions Department. **(02)33-5669**

Editorial and Sales Office:

4th Floor, 15 Boundary St, Rushcutters Bay NSW 2011. Ph: (02)268-9811; Tlx: 27243

Sales Manager: Bob Taylor

Sales Admin: Pam Lord
(address as above)

Melbourne: Virginia Salmon, 150 Lonsdale St, Melbourne Vic 3000. Ph: 662-1222; Tlx AA34543.

Adelaide: Admedia Group, 24 Kensington Rd, Rose Park SA 5067. Ph: 332-8144; Tlx AA82182.

Brisbane: Geoff Horne Agencies, 16 Bellbowrie Centre, Bellbowrie Qld 4070. Ph: 202-6813.

Perth: Aubrey Barker, 133 St Georges Terrace, Perth WA 6000. Ph: 322-3184; Tlx: AA93810

New Zealand: Frank Hargreaves, Circulation Marketing Manager, c/- ACP, 4th Floor, Sun Alliance House, 42-44 Shortland St, Auckland. Ph: (9)30311.

United Kingdom: Australian Consolidated Press, Ludgate House, 107 Fleet St, London EC4A 2AL. Ph: 353-1040; Tlx: 267163.

Japan: Genzo Uchida, Bancho Media Services, 15 Sanyei-cho, Shinjuku-Ku, Tokyo 160. Ph: 359-8866; Cable: Elbanchorito; Tlx: BMSINC J25472 Tokyo.

USA: Australian Consolidated Press, 21 East 40th Street (Floor 23), New York NY 10016. Phone: (212) 685-9570.

The publisher accepts no responsibility for unsolicited manuscripts, illustrations or photographic material.

ORDER FORM

I enclose \$ for (tick appropriate box/es). All prices include postage.

Send orders to: ETI, 4th Floor, 15 Boundary St, Rushcutters Bay NSW 2011. Phone: (02)33-4282.

☐

Subscriptions

\$23.30 per year within Australia

\$

\$36.60 overseas (surface mail)

\$

Airmail rates on application

NAME (Please print)

☐

Back issues

\$2.50, available from November 1978.

ADDRESS

☐

or photocopies

\$2.50 per article per issue

Project No. Month Year \$

Project No. Month Year \$

Project No. Month Year \$

Project No. Month Year \$

Please attach a list if more than four required.

☐

Binders

No. @ \$6.10 in NSW

\$

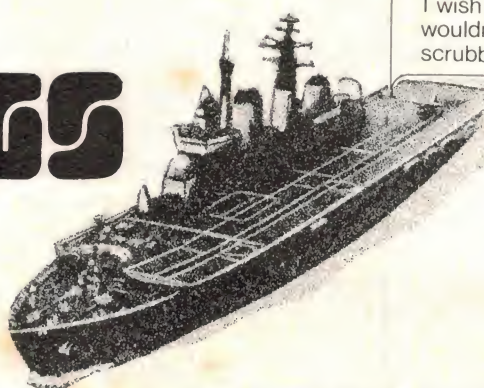
No. @ \$7.50 in other states

\$

POSTCODE



DREGS



I wish the invincible Mrs. Thatcher wouldn't insist on having the deck scrubbed every morning...

Roger who?

The hacks who write for Dregs are currently engaged on a very special project. We're going to modify the Turtle Robot project so that it will operate on vertical surfaces. The Turtle Robot has the unique ability of being able to draw. Now, the B.U.G.A. U.P. people (Billboard Utilising Graffitiists Against Unhealthy Promotions — see Dregs, June 1981) spotted this ability of the Turtle and contracted the Dregs Design Team (D.D.T.) for the special model. The D.D.T. have successfully modified the Turtle's pen solenoid so that it operates a spray can of paint mounted on board, and are currently working on a

suction cap traction system so that the Turtle will crawl around vertical surfaces — rather like a fly. The D.D.T. hope to come up with the world's first 'Electronic, fly-footed, computer-driven robot Turtle'!

Hang on, it's B.U.G.A. U.P. on the phone... they want us to organise the software so that the robot will sign a graffiti-ed billboard with their acronym. No problem. A little routine tucked away at the top of memory, and, with a single keystroke — it signs B.U.G.A. U.P. Wait! B.U.G.A. U.P. want to change their logo! What's that? Roger who? Oh... R.O.G.A. U.P. — Robot Organised Graffitiists Against Unhealthy Promotions!

Electricity crisis

Amidst all the kerfuffle about the electricity crisis in New South Wales recently came this wonderful story from the land of the shamrock and the shillelagh.

Paddy wanted to reduce his electricity bill, figuring (a) it was too much, and (b) he'd have more to spend at the pub. He put a quiet word round at the local and was introduced to a certain fella who showed him how to wind the meter back. "Begorrah," he said to himself, "I'll do it straight away." Reeling his way home he got the ladder, climbed up to the meter and gave it a good twirl.

His next bill came to 600 pounds, not the 60 pounds he usually paid! Then, to add insult to injury, he was hauled before the local beak and fined a further 200 pounds for interfering with the meter. It is not recorded whether Paddy has caught up with the certain fella with the intent to interfere with him.

SONY
THE ONE AND ONLY

Supernatural Sound.

Walkman is guaranteed worldwide for 90 days
under Sony's International Warranty System.



Enter the state of higher fidelity with the new Walkman 2 stereo player, the world's smallest Hi-Fi. It's a sensational way to listen to music on cassettes and raise your awareness of sound. Walkman is so light it practically feels weightless. So small it's hardly bigger than

the plastic case that cassettes come in. And so personal, with headphones that weigh next to nothing, that Hi-Fi has never been more intimate. The new Sony Walkman. It can make your experience of sound infinitely wondrous.

The World's Smallest Hi-Fi
WALKMAN

SON 0114



THE IDEA BEHIND OUR RADIO CASSETTE RECORDERS.

The stereo headphone represents perfect stereo reproduction.

As well as receiving sound through your ears, you appear to receive sound from above your head.

This added dimension in sound is stereo.

Of course, anyone can get this sound from any good stereo radio cassette recorder if they listen through stereo headphones.

But, at JVC, we realised it was impractical to wear stereo headphones all the time.

So we invented a new kind of sound system just for our stereo radio cassette recorders.

The Biphonic System.

This exclusive system offers 3-dimensional sound effects, so you enjoy true stereo reproduction without headphones.

If you'd like to know more about the many innovations JVC has brought to the stereo radio cassette recorder, write to us for a brochure, or call in to any JVC dealer.

Then you'll see why JVC equipment is recognised as The State of the Art.

JVC